

THE
SPRING AIR RIFLE
SPRING TUNING
& SERVICING
MANUAL

CONTENTS

1. Contents.
2. Preface.
3. Tuning Considerations
4. Cleaning
5. Making a Cylinder cleaning tool
6. Cylinder.
7. Transfer Port.
9. Pistons.
12. Washers.
14. Spring Selection.
15. Mainspring.
16. Spring Guide.
18. Fly Shooting.
19. Following Through.
20. Gun Parts Photograph
22. Break Barrel.
25. Tap Loaders.
26. Tap Alignment.
28. Lubricating Instructions.
32. Pellets.
35. Trouble Shooting.
36. Lubricating Washer
37. Velocity Loss Graph
38. Energy of Pellet
39. Lubricants
40. Notes

PREFACE

New Air Gun Shooters

If you have not already purchased your gun then go to a gunshop that has more than a couple of guns in stock. This is so that you can hold the different models, to see which gun suits your style of shooting the most. If the shop owner is a keen airgun shooter then he may be able to offer some helpful advice. If on the other hand he says "the airguns are on the rack over there", and then says that they are all the same it is unlikely that he will be of much help! In this case it could pay to go to an airgun club to get some advice and to get some idea of the different types of airguns that are now available.

Why tune your airgun?

While some may be adequately lubed at the factory, for general airgun use, they may often be improved by careful tuning and lubrication.

Read this book carefully before you decide how far you want to go with your tuning, then you will know what parts you need to buy.

What you can do, as a private owner of a spring air rifle, is to spend more loving care and attention on it than the manufacturer.

There are three basic considerations:

1. You can improve on the standard (mediocre) lubrication.
2. It may also be possible to improve on the materials used in certain components, such as piston heads, springs, & spring guides, by exchanging them for higher-tec items.
3. You could also pay an expert to change some of the designed characteristics such as piston strokes, or transfer port shapes.

The first option is the least expensive and you could achieve improved lubrication with the help of a spring compressor and a few common tools. You cannot safely manage without a spring compressor. As an alternative to paying someone else to work on your rifle for you, you have the choice of buying specialised tools which would enable you to tackle some of the work (such as enlarging the transfer port).

This book is generally intended for most airguns, but certain designs may need something more specific depending on their design.

A book of dismantling and assembly of the most popular airguns, will be available shortly.

TUNING CONSIDERATIONS

IF MY GUN IS NEW SHOULD I STILL TUNE OR LUBRICATE IT?

This is hard to answer, as even when new some airguns may be O.K. for occasional shooting, but for serious use, most will benefit from proper tuning or lubricating., but think about it first as stripping your gun down will most likely invalidate your guarantee.

Occasionally I've stripped a few new guns and found the piston to be going rusty, although this is quite rare, it can be a worrying thought.

Do not strip your gun just to see how it works. Most airguns will work fine for many years with very little attention, so if the gun is performing well it is sometimes wise to leave alone. If you are sure there is room for improvement then this manual can help you get the best performance.

By tuning it your self, it is up to you how much time you spend on it, and how it performs. Most of the hints in this manual have been proved over many years of tuning airguns.

Needless to say, that if you are after the absolute ultimate performance, then some experimenting is required. This is because each gun is individual.

Therefore if your BSA Mercury, for example likes two 1/16" slip rings with a spring of 30 coils of type A, which gives 11.9ft.lbs, then you do exactly the same with an apparently identical Mercury, using spring type A., it is very unlikely that it will produce the same energy. It may give 10ft lbs or even 13ft lbs.

This is due to machining tolerances of all the individual parts, and how they fit together. When Mark 2 Airsporters were still available in the shops, I remember having a really good example that was very powerful and extremely accurate. So I bought another one and it was useless. All the tuning I could do would not bring it anywhere near the good one.

Eventually I bought another two Mk2 Airsporters for experiment. These also left a lot to be desired when compared to my first one.

cont.

I tried interchanging various parts from the two Airsporters (No, I wasn't going to touch the first one, while it was going that well). It was just not possible to approach the power of the first one. Mind you I did not have the facilities I now enjoy.

Eventually I sold that first Airsporter for a bit over the going rate, but I've regretted selling it ever since.

CLEANING

The internal components must be thoroughly cleaned, with all traces of grease and oil removed. We generally use thinners, the cheapest grade of standard cellulose thinners will be O.K. and if purchased from a car paint suppliers, a cheap grade can be purchased. But use with care in an open space and do not breathe the fumes which are highly inflammable and will dissolve many plastics.

So if you are not familiar with using cellulose thinners, use an alternative degreaser, which you are happy to work with.

Make sure all traces of oil and grease are removed, even in the corners at the bottom of the cylinder. Paper kitchen towels can be purchased quite cheaply, and are very handy for degreasing airguns. Especially when used with a wooden dowel, See fig. 1. The plastic paper towel holders are very cheap and could be fitted in the workshop if you intend to do more than the occasional airgun.

MAKING A CYLINDER CLEANING TOOL Fig. 1.

CUT SLOT
WITH SAW.

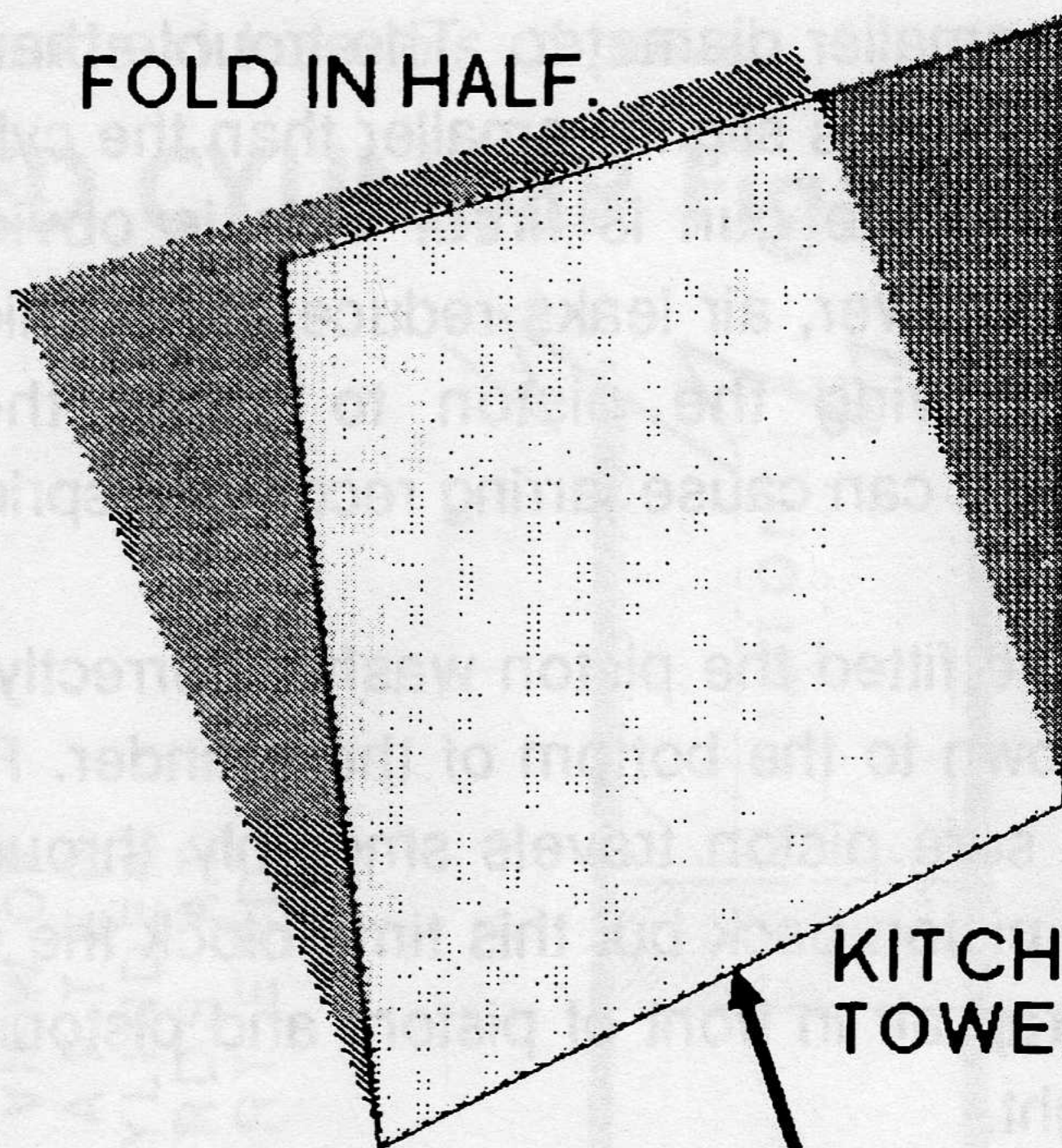
1.1/2

WOODEN
DOWEL.

LENGTH
TO SUIT
DEPTH OF
CYLINDER.

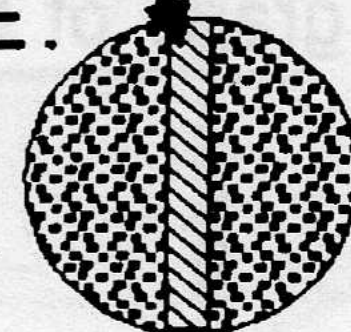
WHEN FOLDED, TUCK FOLDED PART
INTO SLOT. IF IT IS KEPT TURNING
WHILE PUSHING TO THE BOTTOM OF
THE CYLINDER, THIS WILL RETAIN
PAPER TOWEL IN PLACE. MAKE SURE
IT IS KEPT ROTATING, ESPECIALLY
WHEN EXTRACTING FROM CYLINDER.

FOLD IN HALF.



KITCHEN PAPER
TOWEL.

PLACE CENTRE OF
FOLDED, PAPER
TOWEL IN GROOVE.



CYLINDER

After removing spring and end block, pull piston back at a steady rate to see if the cylinder has any tight spots.

A good cylinder should be as straight and as parallel as possible. Therefore a tapered or oval cylinder is often found to be one of the reasons why some guns do not perform as well as expected.

Honing the cylinder will help to remove any high spots. We do not recommend polishing inside the cylinder as this does not guarantee to make it any more parallel but in 99% of cases will make it much worse. This is because it is difficult to polish evenly at the transfer port end, the result being a tapered cylinder, See fig.2 p7, at the end of the piston stroke, where the piston washer comes to rest after firing. This will size the washer to the smaller diameter. The trouble then is that when the gun is cocked, the washer is slightly smaller than the cylinder, which will allow air to escape when the gun is fired. This is obviously very undesirable. Besides losing power, air leaks reduce the cushioning effect of the air on the piston allowing the piston to strike the end of the cylinder excessively. This can cause jarring recoil and spring twang.

When you have fitted the piston washer correctly, check for fit in cylinder by pushing down to the bottom of the cylinder. Feel for any tight spots. After making sure piston travels smoothly through the firing stroke, you can then pull piston back but this time block the exit side of transfer port. This should trap air in front of piston, and piston should bounce back if it is not too tight.

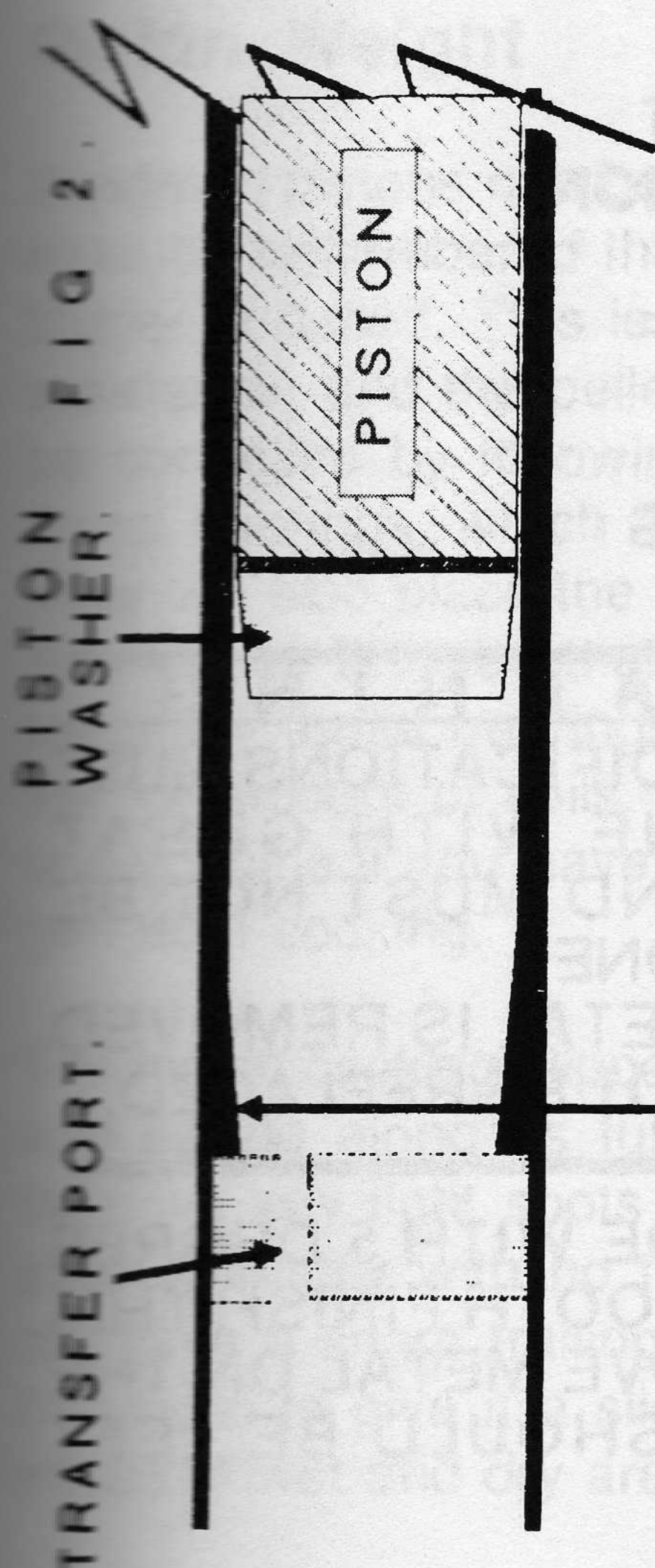
Some guns tend to rattle the stock screws loose. Loose stock screws can cause inaccuracy and the stock to wear, besides making the threads loose. A good remedy is to degrease the threads and use Loctite No. 222 (a stronger grade of Loctite might cause you trouble when removing the screws later.)

TRANSFER PORT

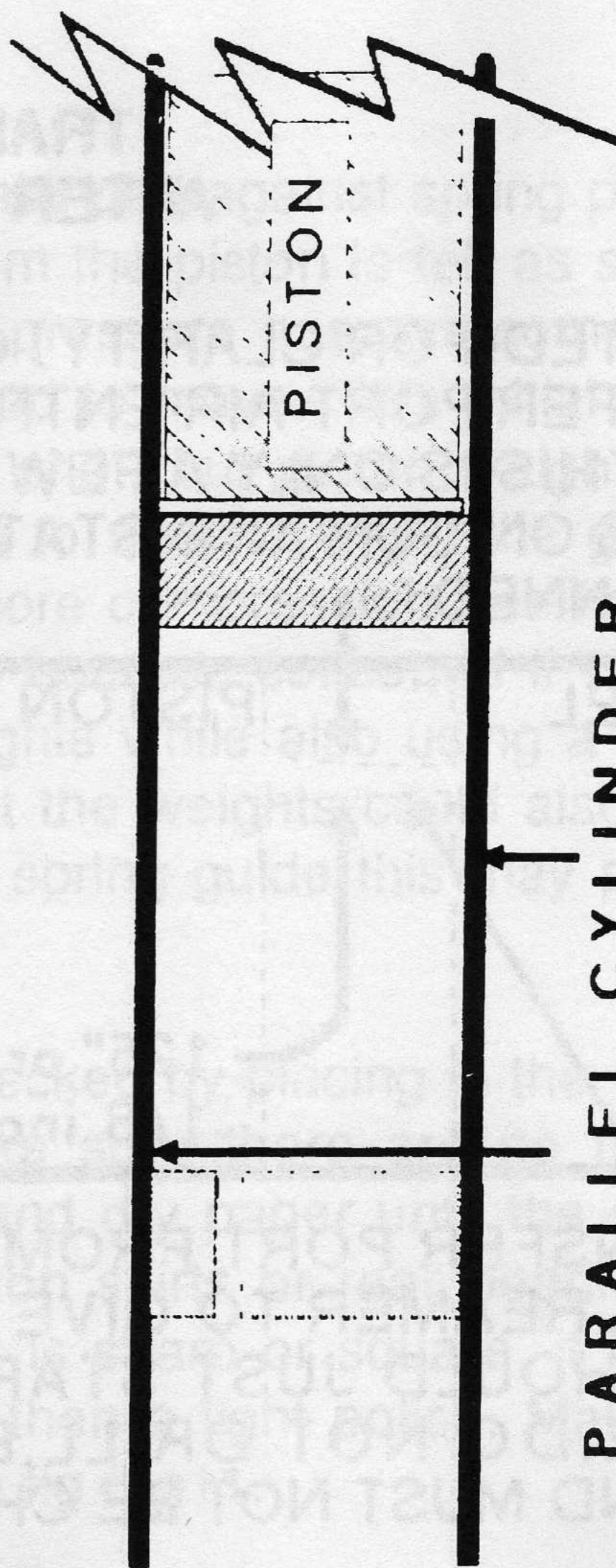
If the gun has a large swept volume like the H.W.80/85 or FWB and the transfer port is not too long, say 1/2" to 5/8" in length then increasing the transfer port diameter can help to increase power, thus allowing you to reduce the spring energy (for a given power) which will reduce the recoil. I would avoid drilling the transfer port to a larger size, because the slightest imperfections will cause a loss of power.

These imperfections disrupt the very high speed air stream. Reaming the transfer port from inside with a special tapered reamer, gives a slight funnel effect and a very smooth finish to assist the air flow. See fig 3 P8. The exit side should be left square. Do not be tempted to take the square edge off as this tends to lose lots of power.

TAPERED CYLINDER Fig. 2.



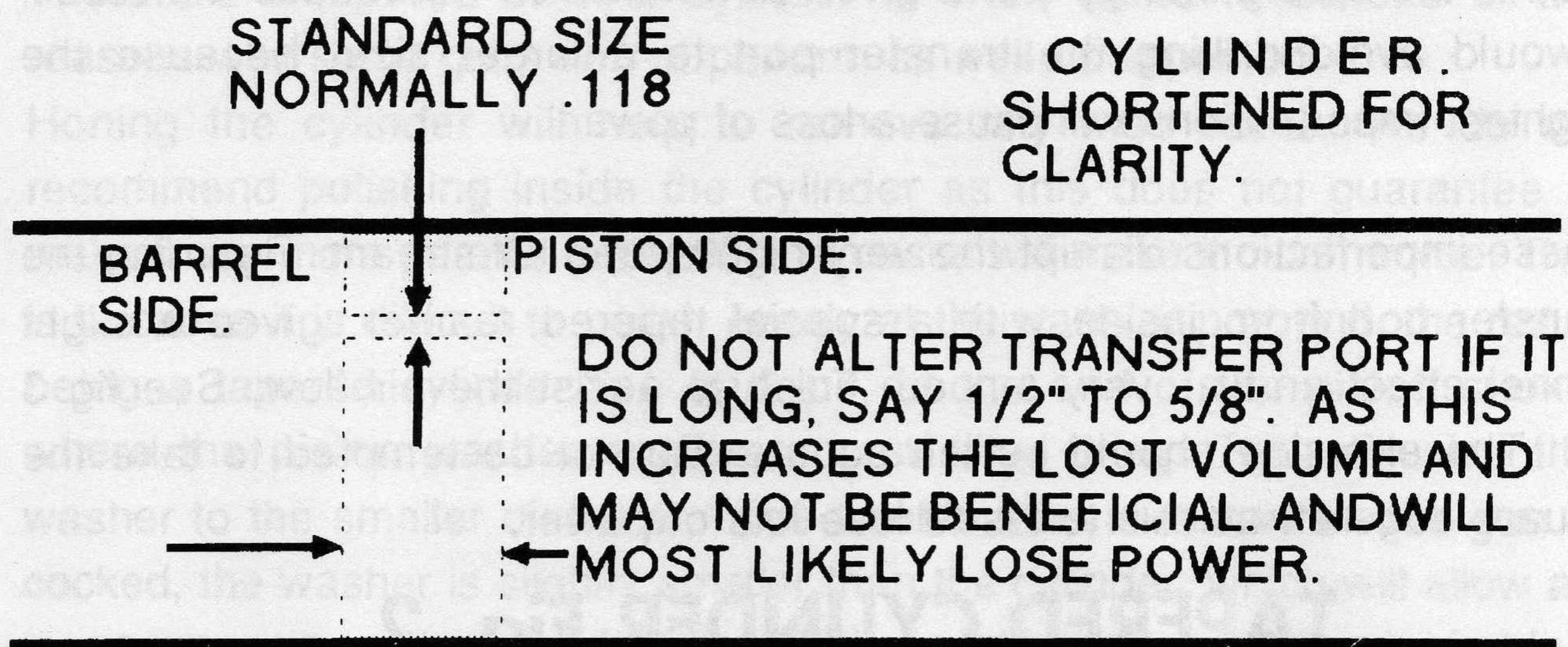
EXAGGERATED VIEW OF
CYLINDER AFTER
POLISHING. CYLINDER
TAPERS INWARDS AT
TRANSFER PORT END



PARALLEL CYLINDER.
IF CYLINDER HAS A ROUGH FINISH OR IS
NOT PARALLEL, THEN HAVING IT HONED
WILL HELP TRUE IT UP. THE COMPRESSION
CHAMBER IS VERY IMPORTANT, AND
SHOULD BE AS PARALLEL AS POSSIBLE
FOR MAXIMUM EFFICIENCY

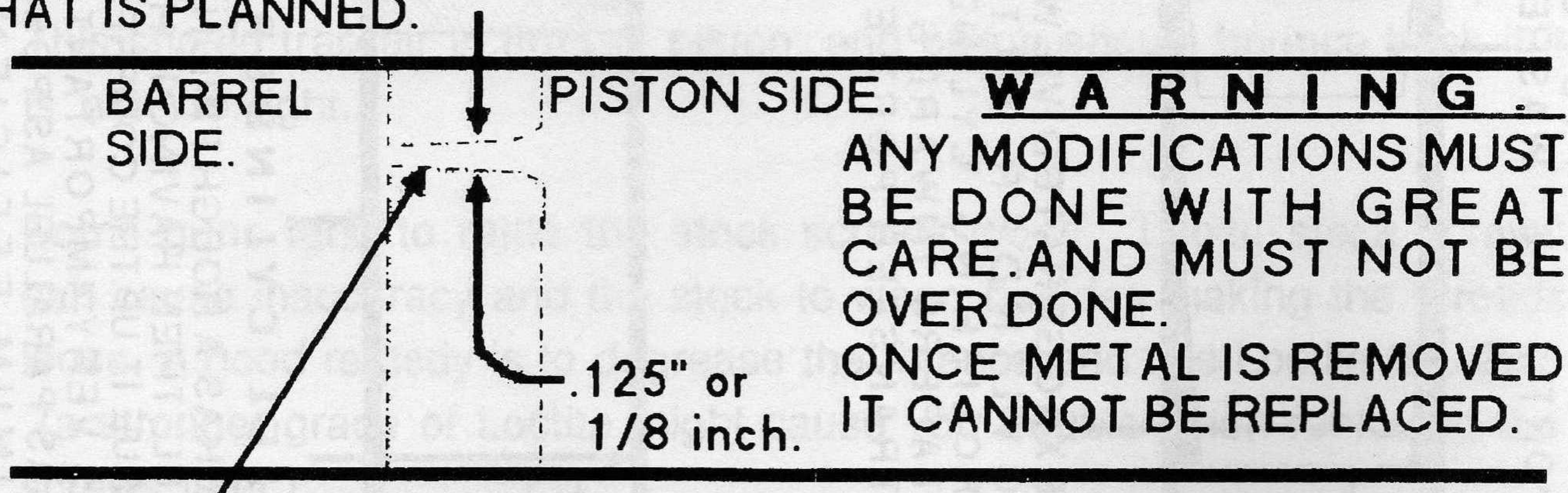
TRANSFER PORT Fig. 3.

TRANSFER PORT. BEFORE MODIFICATION.



TRANSFER PORT. AFTER MODIFICATION.

EXAGGERATED(FOR CLARITY) CHAMFER OF
THE TRANSFER PORT AIR ENTRY SIDE. IN
PRACTICE THIS IS ONLY A FEW THOU
DEPENDING ON GUN AND STATE OF TUNING
THAT IS PLANNED.



REAM TRANSFER PORT FROM PISTON SIDE WITH 5 DEGREE
INCLUSIVE REAMER TO GIVE A VERY SMOOTH FINISH. THIS
REAMER SHOULD JUST START TO REMOVE METAL ON THE
EXIT SIDE. DO NOT DRILL. EXIT SIDE SHOULD BE LEFT
SQUARE. AND MUST NOT BE CHAMFERED.

PISTONS

Pistons

Some guns have a slot in the piston for the cocking arm. So when lubricating the spring don't put too much lubricant on, as it may find it's way through this slot and get behind the piston washer. The lubricant will then be wiped on the cylinder walls when the gun is cocked, then when the gun is fired, the high compression and heat created will cause dieseling. This can break the mainspring or damage the gun.

Piston Sleeve

Some guns already have sleeves (e.g. HW80, 85 & Original 45) yours may not. If there is enough room between the spring and inside of piston, it can be beneficial to fit a piston sleeve, to isolate the piston slot. This will prevent lubricant from getting to the piston washer, See fig.4 p10 provided the lubricant is not too thin. MS2 is the correct viscosity for this. A piston sleeve will not prevent oil escaping if gun is over lubricated.

Piston Weight

Weighted pistons can be beneficial if balanced against spring power, but it must be remembered that the recoil from the piston is felt as soon as the trigger is pulled. This is before the air pressure has overcome the pellet resistance, and the pellet has not started to move. This initial recoil must be controlled by following through the shot, but piston weights are also thrust bearings, which allow the spring to unwind when the gun is fired. They will also place the spring under more compression. See fig.5 p11 The trouble can then be that the spring will become coilbound if you try to fit too many thrust bearings or piston weights while also using a spring with the full amount of coils. Remember that the weights could also touch the spring guide. If you have fitted a longer spring guide this may prevent the gun from cocking.

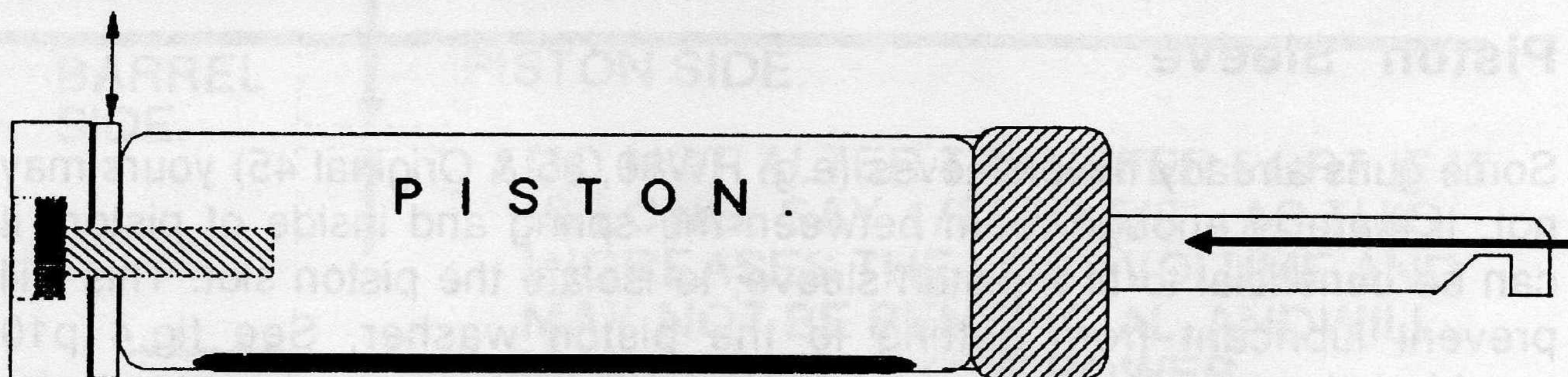
The piston cocking slipper should be checked by placing in the piston slot and sliding along its full travel to make sure there are no tight spots. Remove any tight spots with 600 wet and dry paper until the slipper will slide smoothly with no tight spots. Piston skirts or rear bearings should not have a sharp trailing edge. If yours is sharp or square, it is normally beneficial to give it a slight radius and then a light polish. Make sure all traces of wet and dry are removed. See fig.6 p11.

PISTON SHIM Fig. 4.

TO MAKE STEEL PISTON SHIM.

PISTON SLEEVE, MADE FROM SHIM STOCK, A THIN METAL FOIL.

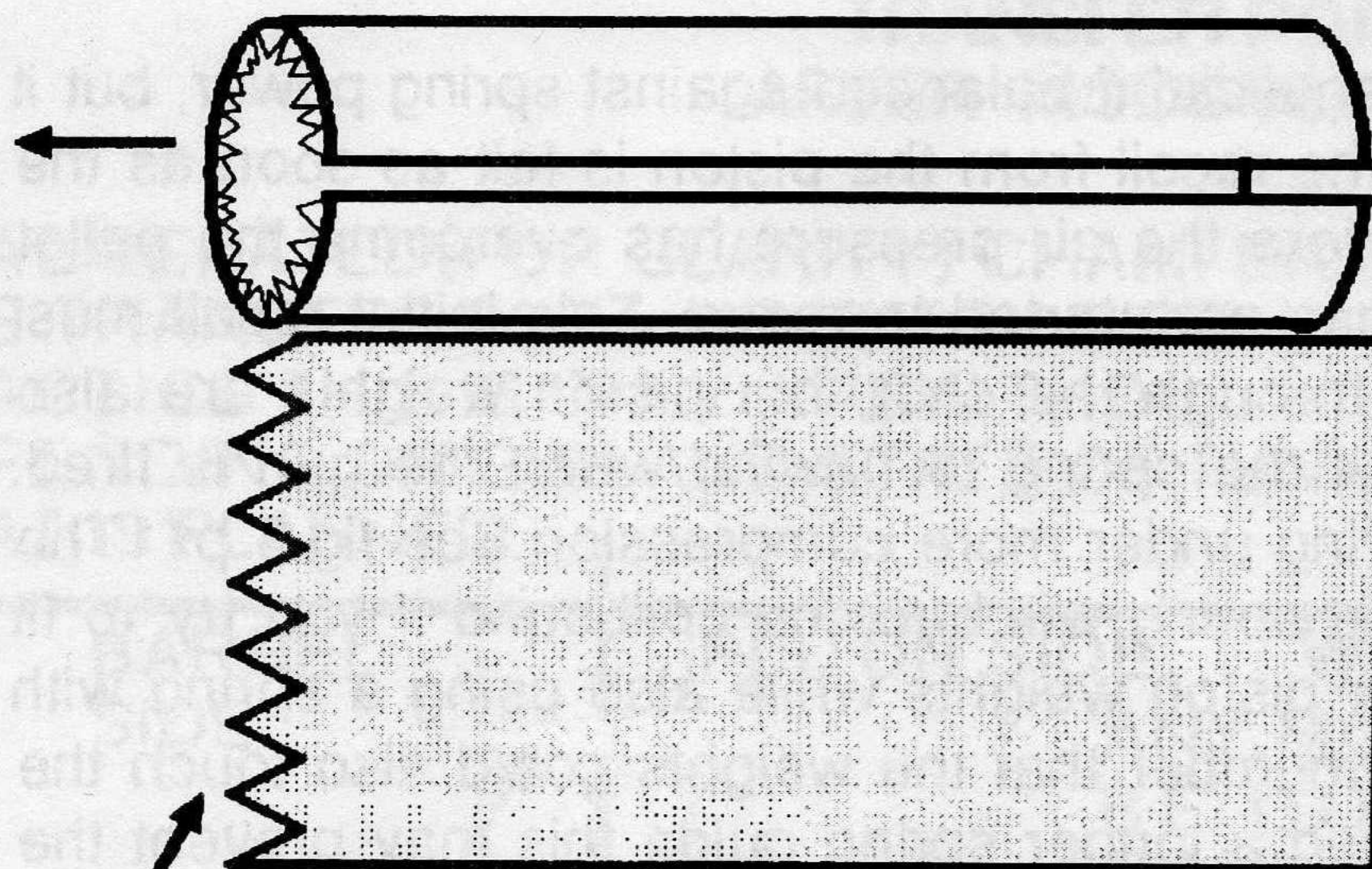
BACKING WASHER.



PISTON.

PISTON SLOT.

WRAP AROUND SPRING, MAKE SURE SHIM GAP FACES AWAY FROM PISTON SLOT. TO PREVENT LUBRICANT ESCAPING. TABS ARE TO RETAIN SHIM INSIDE PISTON.



STEEL SHIM.
3 TO 5 THOU. THICK.

BEND TABS AT 90 DEGREES,
WITH FLAT SIDED PLIERS.

PISTON Figs. 5.&6.

CROSS SECTION.

PISTON WEIGHTS INCORPORATE A SHORT SPRING LOCATOR. THIS MUST NOT BE TOO LONG OR IT MAY CLASH WITH SPRING GUIDE, AND PREVENT GUN FROM COCKING.

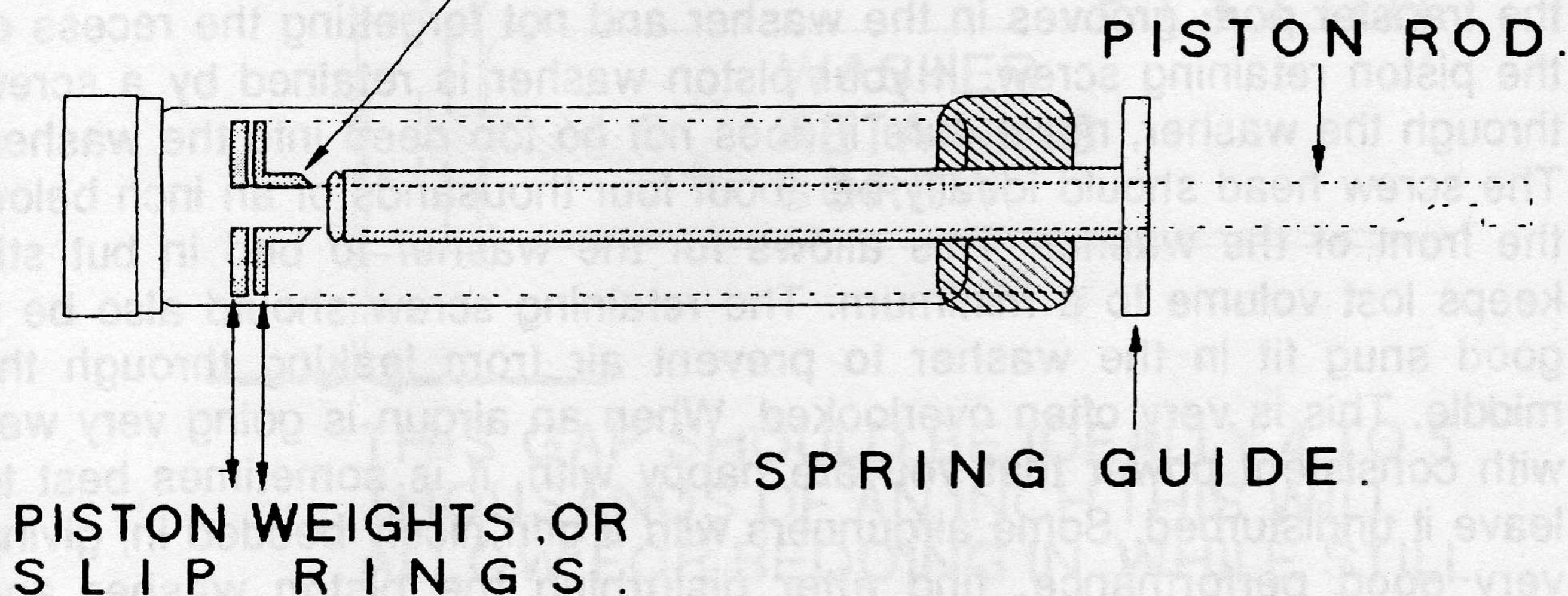
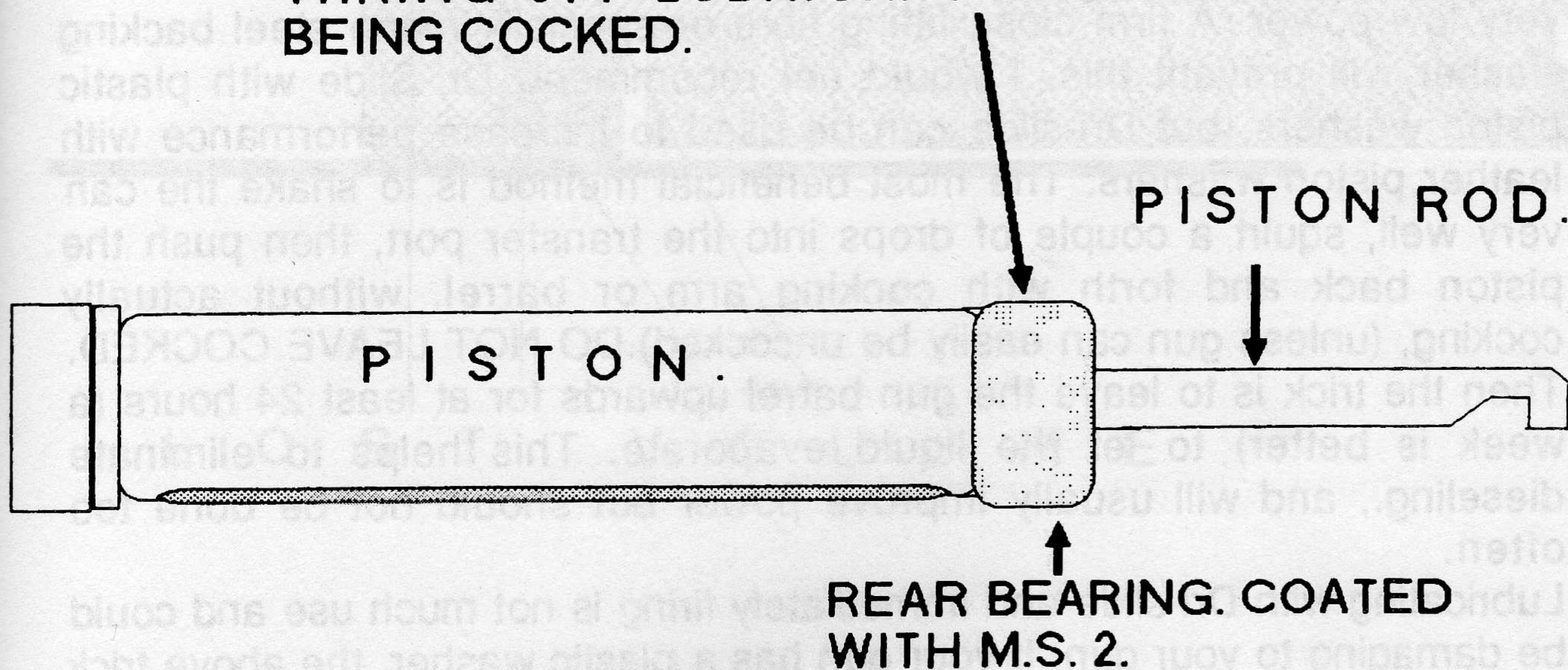


FIG. 6.

IF REAR BEARING HAS A SHARP EDGE. THIS SHOULD BE JUST ROUNDED OFF, WITH 600 WET AND DRY. THIS WILL AVOID IT ACTING AS A SCRAPER RING AND TAKING OFF LUBRICANT WHEN GUN IS BEING COCKED.



WASHERS

Generally, leather washers must not be too soft, as this can cause over expansion on firing, forcing a soft washer to grip the sides, thus slowing it down, reducing power and increasing recoil. This can also apply to synthetic washers, which may have been deeply grooved to produce a feathered edge.

This groove must not be too deep for the above reasons, but also because it increases the lost volume. Lost volume is the wasted space of air at the end of the piston stroke that cannot be compressed, such as the transfer port, grooves in the washer and not forgetting the recess of the piston retaining screw. If your piston washer is retained by a screw through the washer, make sure it does not go too deep into the washer. The screw head should ideally be about four thousandths of an inch below the front of the washer. This allows for the washer to bed in but still keeps lost volume to a minimum. The retaining screw should also be a good snug fit in the washer to prevent air from leaking through the middle. This is very often overlooked. When an airgun is going very well with consistent power that you are happy with, it is sometimes best to leave it undisturbed. Some airgunners with a gun nicely bedded in, giving very good performance, find after disturbing the piston washer and spring, that when reassembled, the power has dropped. This is because it will take a long time to settle down to it's optimum again.

If you suspect the spring has weakened but the washer is O.K. and the piston is known to be previously lubricated properly, change the spring without removing the piston. Most leather piston washers have a fibre backing washer fitted behind the main piston washer to support it. This prevents the washer from being dragged back between the front of the piston and the cylinder wall. The result would be very high friction and very low power. A firm close fitting fibre or specially made steel backing washer will prevent this. I would not recommend Dri-Slide with plastic piston washers, but Dri-slide can be used to increase performance with leather piston washers. The most beneficial method is to shake the can very well, squirt a couple of drops into the transfer port, then push the piston back and forth with cocking arm or barrel, without actually cocking, (unless gun can easily be uncocked). DO NOT LEAVE COCKED. Then the trick is to leave the gun barrel upwards for at least 24 hours (a week is better) to let the liquid evaporate. This helps to eliminate dieseling., and will usually improve power but should not be done too often.

Lubricating with Dri-slide and immediately firing is not much use and could be damaging to your gun. If your gun has a plastic washer, the above trick does not work and may lose power.

LOST VOLUME Fig. 7.

MAIN PISTON WASHER.

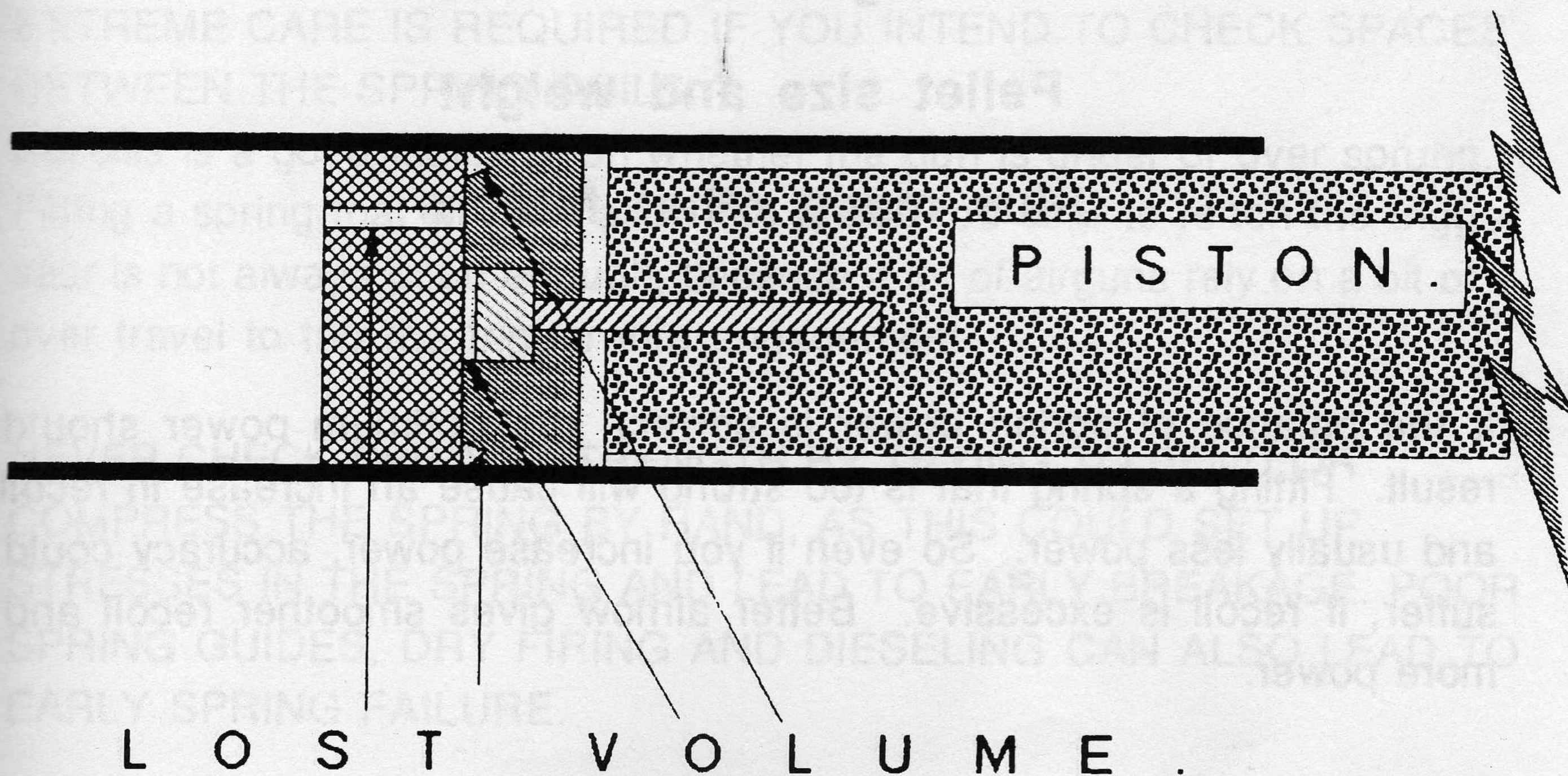
BACKING WASHER.

PISTON.

WASHER
RETAINING
SCREW.



THIS GAP SHOULD BE IDEALLY 4 TO 5 THOUSANDS OF AN INCH. THIS WILL ALLOW FOR BEDDING IN, WHILE STILL KEEPING THE LOST VOLUME TO A MINIMUM.



SPRING SELECTION

The strength of spring, or spring fitted is influenced by many things:-

Design of air gun

Swept volume

Piston washer leaks

Breech seal leaks

Tap leaks (Underlevers only)

Transfer port dimensions and shape

Piston washer and Piston fit

Lubrication

Weight of Piston

Pellet size and weight

Plus many other factors

If the balance of spring power is correct, the optimum power should result. Fitting a spring that is too strong will cause an increase in recoil and usually less power. So even if you increase power, accuracy could suffer, if recoil is excessive. Better airflow gives smoother recoil and more power.

See transfer port dimensions. See fig.3 p8.

MAINSRING

When you remove the old spring count the number of coils of the old spring and compare it with the new one, to make sure there is approximately the same amount of coils and that the wire diameter is the same.

Example:- Old spring has 31 coils of .128 diameter wire.

The new one should be approximately the same. This is assuming that there was not an excessive amount of space between the coils when the gun was cocked using the old spring.

Example: 31 times .128 = 3.96 inches of solid spring height. So long as the solid spring height is not more than this figure i.e. 3.96 inches of solid height, then the gun should still cock before the spring is coil bound.

Fitting a much stronger main spring than standard imposes great strain on the trigger mechanism. So if you are contemplating fitting a high power mainspring, give a thought to the trigger mechanism and if it is a bit suspect, perhaps you should think about working on a better gun.

WARNING

EXTREME CARE IS REQUIRED IF YOU INTEND TO CHECK SPACES BETWEEN THE SPRING COILS.

But this is a good indicator on whether the gun is under or over sprung. Fitting a spring that will just allow the piston rod sear to reach the trigger sear is not always good enough, because a lot of airguns rely on a bit of over travel to trip the trigger into engagement.

NEVER CHECK SPRING STRENGTH BY TRYING TO BEND OR COMPRESS THE SPRING BY HAND, AS THIS COULD SET UP STRESSES IN THE SPRING AND LEAD TO EARLY BREAKAGE. POOR SPRING GUIDES, DRY FIRING AND DIESELING CAN ALSO LEAD TO EARLY SPRING FAILURE.

SPRING GUIDE

It is permissible for the spring to be a tightish fit on the spring guide. This will prevent excessive buckling of spring which will prevent outside diameter of spring from rubbing on the inside of piston.

If too large a spring outside diameter is fitted a great deal of power will be lost even though the spring may be very powerful. This is caused by the excessive friction created by the spring expanding on cocking and rubbing on the inside of piston. The less friction you have, the more efficiently the gun will perform.

The large part of the guide should be a good fit in the cylinder, preferably with only a few thousands of an inch clearance. This ensures the piston rod is kept central when the gun is cocked.

A sign of the piston rod, not staying central is a slight resistance just before trigger engagement. This happens when the piston rod fouls the end block, instead of sliding into the hole, as intended See fig 8 p17. If this is severe, the piston rod may need centralizing, but if the rod appears to be central then check the rear piston bearing fit in the cylinder. As excessive wear on the back of the piston bearing will allow the whole piston to move upwards to the scope rails. See fig.8 p17.

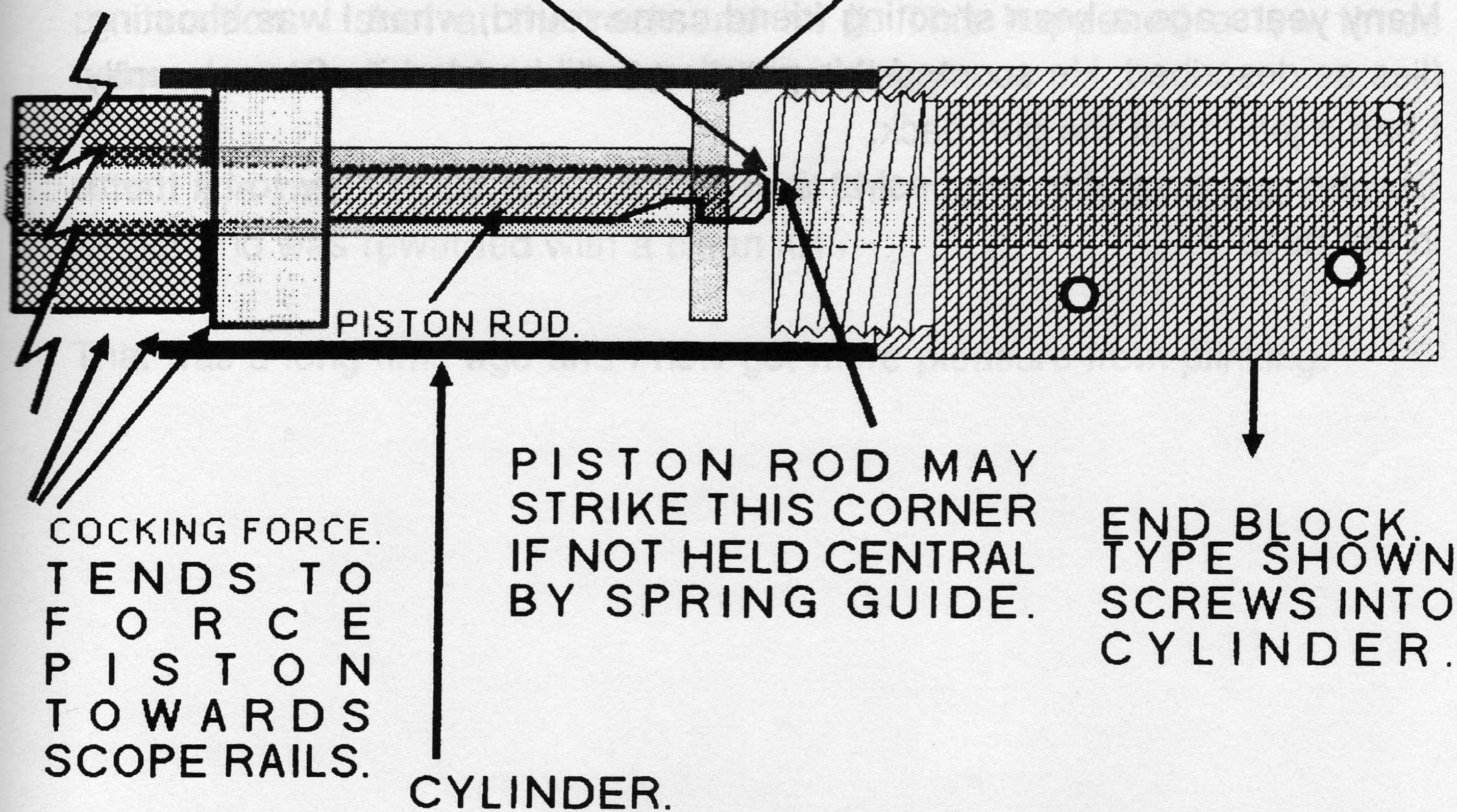
It is possible to have a brass or bronze bush made and silver soldered or brazed to the piston bearing to cure this problem but it is expensive. Although, if you intend to do a good job, then the resultant smoothness and reduced friction may be worth it.

SPRING GUIDE Fig. 8.

A SPRING GUIDE THAT FITS THE CYLINDER. WILL KEEP THE PISTON ROD CENTRAL.

SPRING GUIDE IS A POOR FIT IN CYLINDER.

THIS ALLOWS PISTON ROD TO STRIKE END BLOCK, WHEN THE GUN IS NEAR THE END OF THE COCKING STROKE.



FLY SHOOTING

If you cannot get out to shoot for a while, then you could try shooting flies.

All you need is a low powered air rifle and a safe backstop like an old mattress or old blankets to stop any possibility of a ricochet. Place the blankets in front of a brick wall. Then just in front place a small amount of old cat food or similar. Then sit about twelve feet away with some pellets, and wait for the flies to fly in the safe range area where you have placed the food. This need only be about three square feet.

Shooting flies is good practice and keeps these pests down. It may sound silly but I can assure you, it can be good safe fun so long as proper safety procedures are followed.

Many years ago a keen shooting friend came round, when I was shooting flies as described. He scorned this practice, until he tried it. Consequently I had a job to get the gun back.

Obviously open sights are best at such close range, but still try to hit them in the head!?

FOLLOWING THROUGH

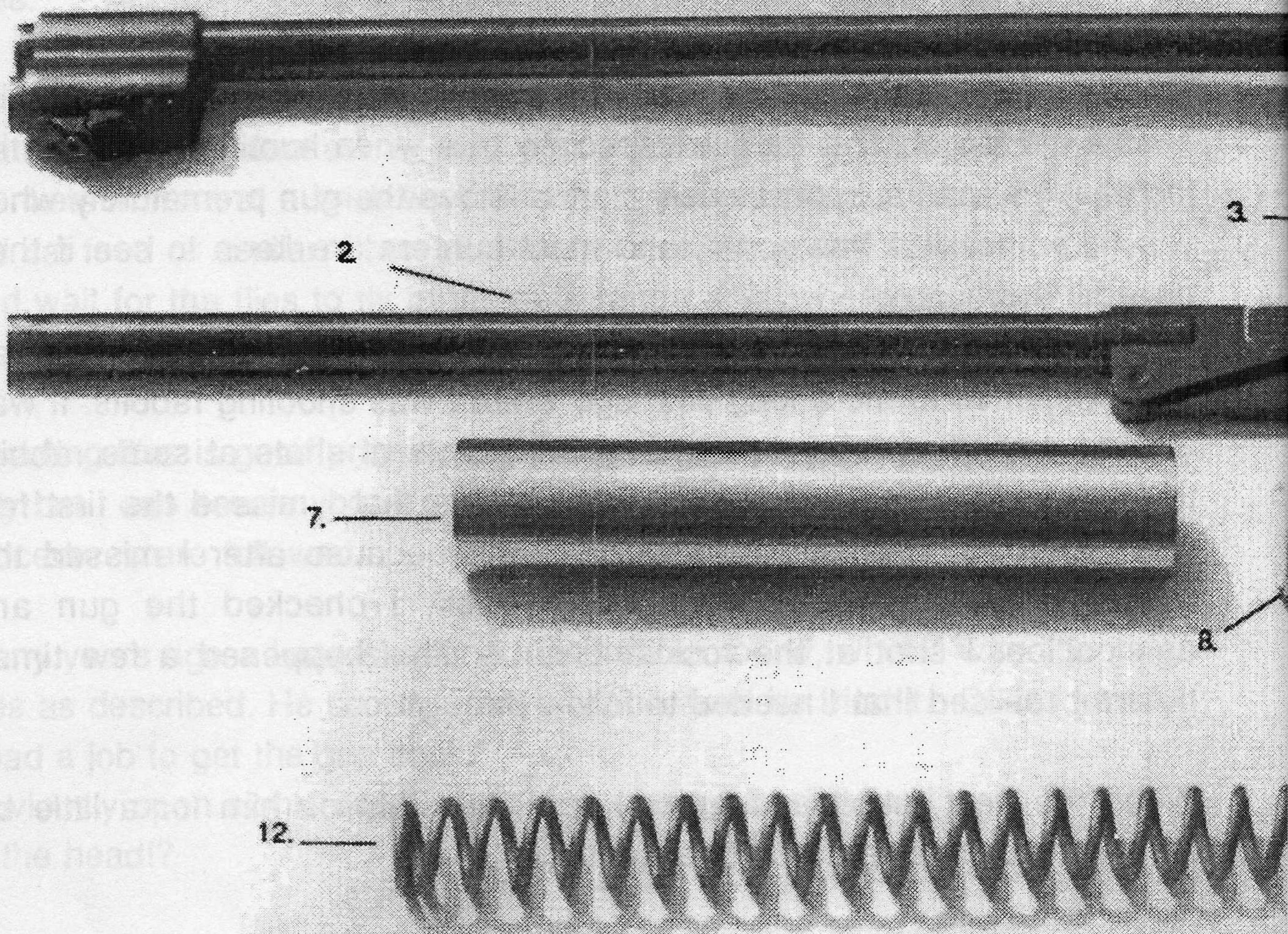
I feel it is worth pointing out the importance of following through after squeezing the trigger.

The idea is to maintain the sights on target momentarily after the pellet has hit the target. This can be especially true when hunting, owing to the fact that you can subconsciously start to move the gun prematurely when you think the shot has gone., and most hunters are keen to see if they have hit the quarry.

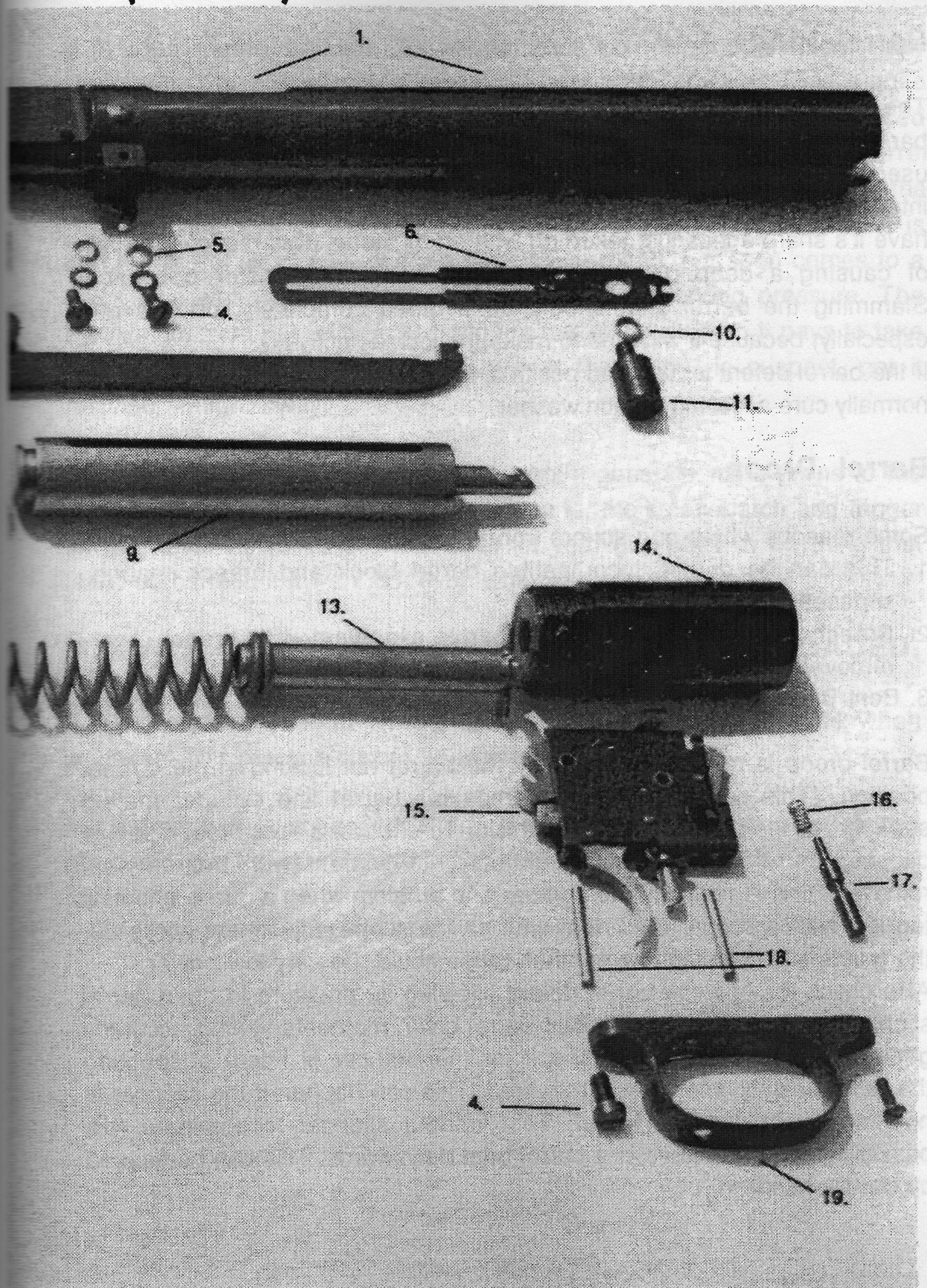
This happened to me a long time ago when I was shooting rabbits. It was a good day when I happened to get a couple of shots at some rabbits that were well within range. The trouble was that I missed the first few that I shot at. What occurred puzzled me because after I missed the rabbit, which had been sitting by a rock, I checked the gun and ammunition. I shot at the rock and hit it. This happened a few times before I realised that I needed to follow through.

When the next rabbit appeared, I held the sight on him for a little bit longer and was rewarded with a clean kill.

That was a long time ago and I now get more pleasure from plinking.



1. Barrel & Cylinder Unit
2. Cocking Lever
3. Cocking Lever pin
4. Stock Screws
5. Stock Washers
6. Anti bear trap unit
7. Compression Cylinder
8. Piston Washer
9. Piston
10. Anti bear trap locating washer
11. End block nut
12. Mainspring
13. Spring guide
14. End block
15. Trigger unit
16. Safety catch spring
17. Safety catch
18. Trigger retaining pins
19. Trigger guard



BREAK BARREL

Barrel Hinge Bolt

The barrel hinge bolt should be tightened just sufficiently so that the barrel will just stay in any position when the gun is cocked. If the gun is used a lot, it could pay to lubricate the pivot points only, at a regular interval with a little MS2 to prevent seizure. The HW35 barrel lock could have its sharp edges just taken off with an oil stone. This reduces the risk of causing a deep groove being worn near the transfer port face. Slamming the barrel shut should be avoided completely, on this gun especially, because it will tend to make the lock defective.

If the barrel detent is nice and positive, then a new breach seal will normally cure a leaking breach washer.

Barrel Droop

Some reasons why a gun suffers from barreldroop:-

1. This can be due to incompatible barrel block and breech mating surfaces.
2. Breech seal too thick. Check barrel alignment with breech seal removed.
3. Bent Barrel

Barrel droop is normally caused by the barrel not locking in the correct position. (This can be due to incompatible barrel and cylinder mating surfaces, or the breech seal is too thick.) To check if a thick breach seal is causing barrel droop, just check barrel alignment with breach seal removed. This is normally the number one problem when a gun is shooting too low with a scope fitted, that with all the scope adjustment clicks up, the gun is still shooting low. Another cause could be very low power.

Also check for a weak barrel detent allowing air pressure to open barrel slightly on firing. This would point barrel down momentarily and accuracy generally would suffer. Also check for the silencer (if fitted) obstructing the pellet slightly when the gun is fired. This can happen if the silencer is not accurately fixed to barrel. Test without silencer to eliminate this possibility. Another cause is a barrel bent downwards. This can be caused by clumsy handling.

Break Barrel Cont.

If the gun shoots too high and will not zero with scope adjustments fully down, then the most common cause is a bent barrel upwards. This is quite common on guns that have been abused, or used by inexperienced shooters. The cause being that when cocking the gun, the barrel accidentally slips from the hand when the gun is nearly cocked, or the trigger is not positive in action and does not engage fully. The result is that the barrel flies upwards from the cocking hand, but soon comes to a quick stop when the breach slams shut from the spring pressure. The momentum from this will easily bend the barrel upwards so it pays to take great care when cocking any air gun. If the trigger is suspect, get it rectified straight away.

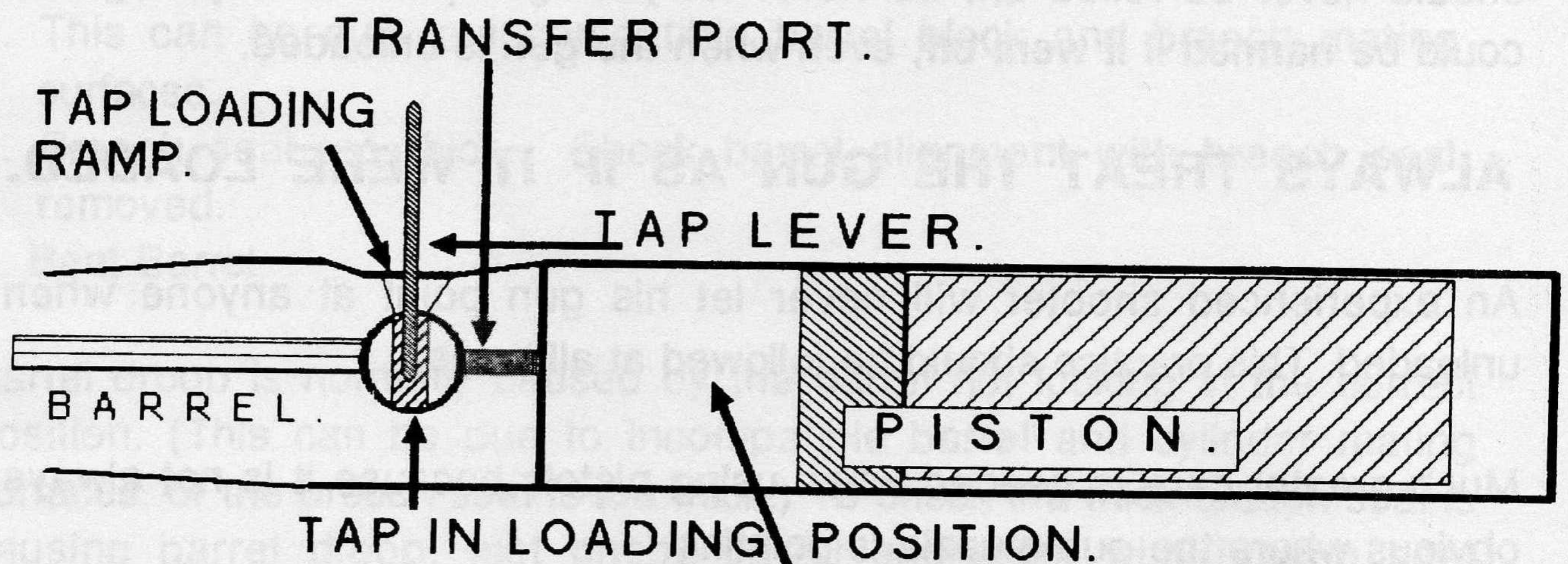
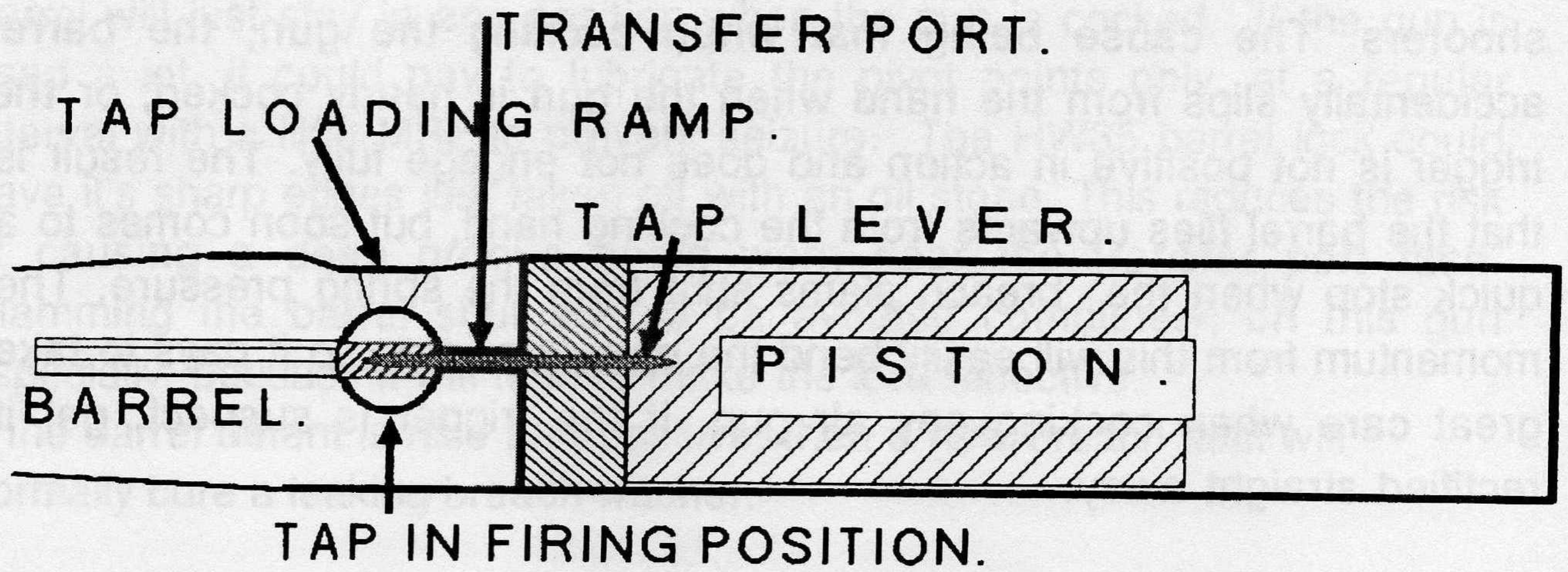
A faulty trigger is not uncommon but certain guns are more prone to the fault. But no matter how reliable your gun is, the safety catch and trigger should never be relied on. So never let your gun point at anything that could be harmed if it went off, even when the gun is unloaded.

ALWAYS TREAT THE GUN AS IF IT WERE LOADED.

An experienced shooter will never let his gun point at anyone when unloaded. This practice should be followed at all times.

Much greater care is needed when using pistols because it is not always obvious where the gun muzzle is pointing.

CHECKING LEAKING TAPS Fig. 9.



TRAPPED AIR SHOULD NOT BE ABLE TO ESCAPE EASILY.
WHEN TAP IS IN THE OPEN POSITION.

**WARNING NEVER ALLOW GUN TO BE FIRED WHEN
TAP IS IN THE OPEN POSITION.**

TAP LOADERS

Leaking Taps

Some tap-loading guns can be uncocked without firing. To check a suspect loading tap, cock the gun and open the tap, as though you are about to insert a pellet. Maintain full pressure on the underlever, and squeeze the trigger. **WATCH OUT.** You must be already holding back the full spring tension. Uncocking the gun carefully, allows the piston to move forward under spring pressure, but as the tap is in the loading position, the air trapped should not be able to escape easily. So if tap and piston washer are 100% air tight, the piston would be held back from the end of the cylinder on the cushion of trapped air. So when tap is closed slowly, the air will be heard to rush out. The chances of the tap and piston washer being 100% air tight is almost unheard of. Especially if the spring has any strength., but in practice, if after you have uncocked the gun, with the tap still open, you can count to 4 or 5 seconds, before all the trapped air has escaped the performance should not be too adversely affected.

If the tap leaks excessively but is tapered like the old Webley Mark 3 and Mark 1 & 2 Airsporters, it is possible to have the tap hard nickel plated by a couple of thousands of an inch. Then the plated tap can be lapped back into it's seating. Great care is needed to ensure the pellet chamber is exactly in line with the rifling or bore, when closed. This is the reason why you cannot lap in the tap without nickel plating, to build up the tap body. This trick cannot be done on later airsporters or guns with parallel taps. This is because if the tap is plated and is then a couple of thousands of an inch larger, the enlarged tap would not enter the parallel hole, making it impossible to lap in.

If tap is found to leak excessively, the answer is not so simple as changing the breach washer.

Packing with grease is of no use as the high pressure would soon blow out the grease, probably after only ten shots, unless the gun is very weak.

TAP ALIGNMENT

A worn tap can move out of line after a lot of use.

Rod and pellet tap alignment test:-

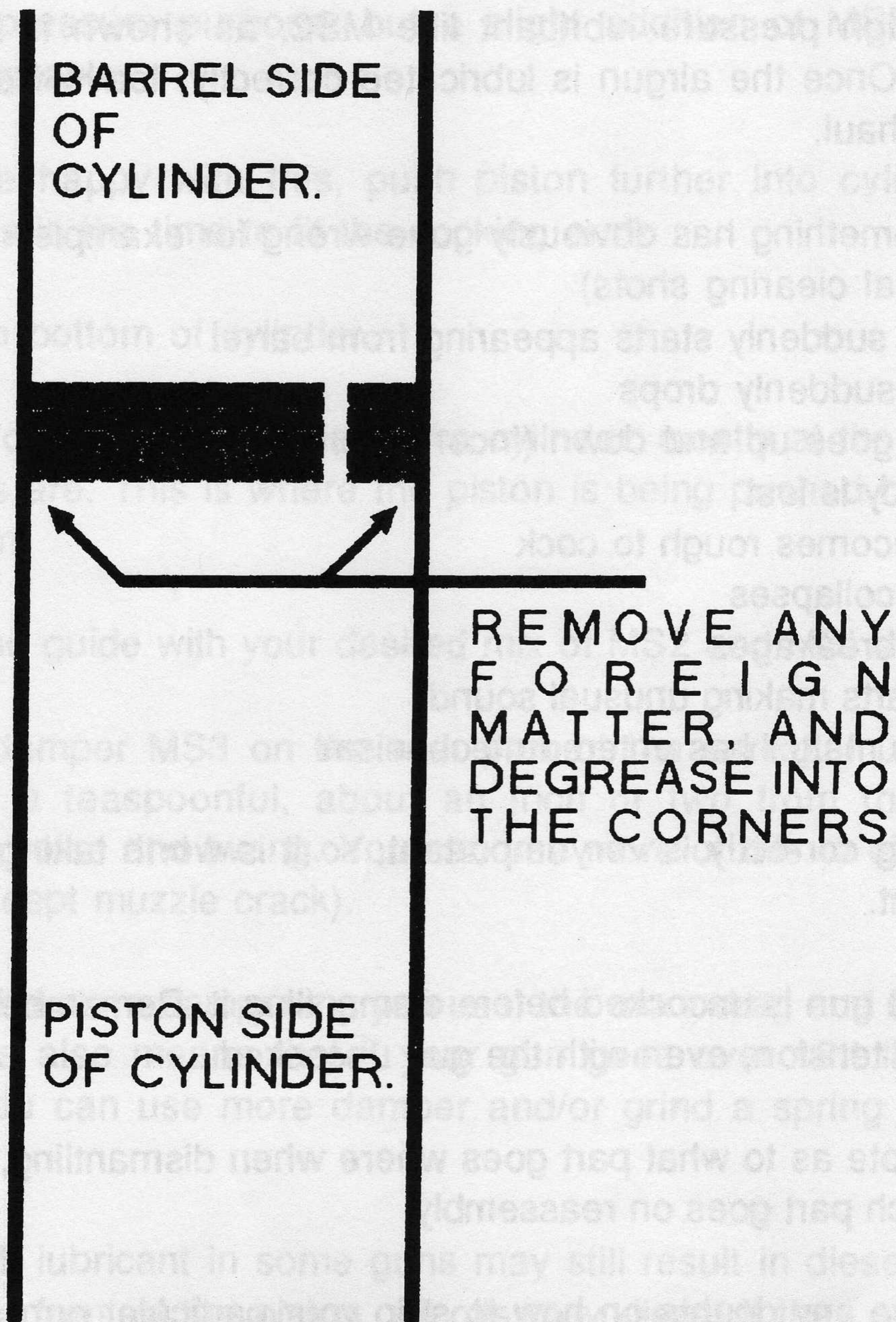
This can be checked when the gun is dismantled by pushing a pellet nose first into the muzzle. Measure a brass cleaning rod to ensure pellet will just reach the tap chamber. Push through from the muzzle and the pellet should enter the tap chamber easily with no catching. If it is found to catch, there is another dimension you can check for and that is:-

Tap closed location. (This is quite rare however).

If a tap is suspected of closing too much, then a fine feeler gauge can be inserted between tap locator plate and tap stop. Then the rod and pellet test tried again, until it is known exactly what is required and then a new tap locator plate made, if a new one does not cure the problem. Or as is most likely, wear has allowed the tap to move over (by light tap spring force) out of line.

CLEANING CYLINDER Fig. 10.

CUTAWAY VIEW OF CYLINDER.



LUBRICATING INSTRUCTIONS

I have not found any oil that will not cause dieseling in a high powered spring air rifle. Even after re-assembly, it is not unknown for a high powered air rifle to diesel even when lubricated correctly. So don't be too worried if the gun smokes a little when first put together. This is acceptable if it soon clears. If the gun is still dieseling after twenty shots, it is likely that it has been wrongly lubricated and the lubricant is getting to the front of the piston. This is why the piston should be dry except for the larger back bearing which is in contact with the cylinder. This should have a high pressure lubricant like MS2, as shown in the lubricating diagram. Once the airgun is lubricated correctly, leave well alone till the next overhaul.

Unless something has obviously gone wrong for example:-

(After initial clearing shots)

1. Smoke suddenly starts appearing from barrel
2. Power suddenly drops
3. Power goes up and down (inconsistent power)
4. Accuracy is lost
5. Gun becomes rough to cock
6. Spring collapses
7. Spring breakages
8. Gun starts making unusual sound
9. Foreign matter has entered mechanism

Lubricating correctly is very important, so it is worth taking your time to get it right.

Make sure gun is uncocked before dismantling it. Remember the spring is still under tension, even with the gun uncocked.

Make a note as to what part goes where when dismantling, so you know where each part goes on reassembly.

If you have any doubts on how to strip your particular gun, ask your gunsmith to help you.

Lubricating Instructions Cont.

With the gun dismantled degrease all parts, as in cleaning section See fig10 p27. Then remove any foreign particles, pieces of lead etc which may be at the bottom of cylinder.

After fitting washer (with a drop of Loctite on the fixing screw) place piston in cylinder with the last third exposed See fig.12 p.31.

This bearing or contact area is coated with MS2. Do not overthin MS2 for this high pressure purpose, but a slight addition of MSI or my oil thinner is acceptable.

When you are happy with this, push piston further into cylinder (with most guns, this is the time to fit the cocking arm).

Push piston to bottom of cylinder.

Rub in a light coating of MS2 inside the cylinder, mostly at the top where the scope rails are. This is where the piston is being pushed hard, in the cocking motion.

Coat spring and guide with your desired mix of MS2 and MSI as required.

Apply spring damper MS3 on the rear part of the spring. I usually like approximately a teaspoonful, about an inch or two from the rear, to prevent spring noise and twang. You can use more of this to eliminate all firing noise (except muzzle crack).

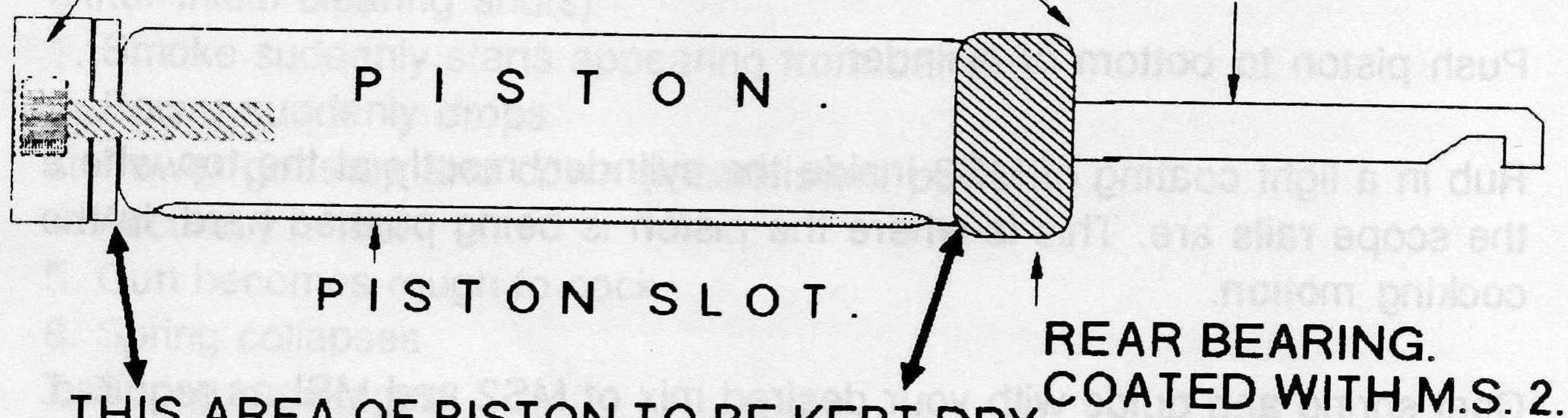
Remember - The more dampening you use, the more drag and less power will result. This also means that if your gun goes over 12ft lbs (British Power limit) you can use more damper and/or grind a spring coil off to reduce power.

Using too much lubricant in some guns may still result in dieseling if the lubes get to the front of the piston. All oils may diesel if they get into the airgun compression chamber. Making a piston sleeve from shim or whatever can prevent lubes from reaching the front of the piston to cylinder walls. See fig. 4 p10.

PISTON LUBRICATION Fig. 11.

IF REAR BEARING HAS A SHARP EDGE.
THIS SHOULD BE JUST ROUNDED OFF,
WITH 600 WET AND DRY. THIS WILL
REDUCE WEAR ON CYLINDER WHEN GUN
IS BEING COCKED.
RUB IN M.S.2 THOROUGHLY TO ENSURE
PROPER PENETRATION.

ONE DROP OF M.S. 40
SILICONE OIL, WIPED AROUND
PLASTIC WASHER.

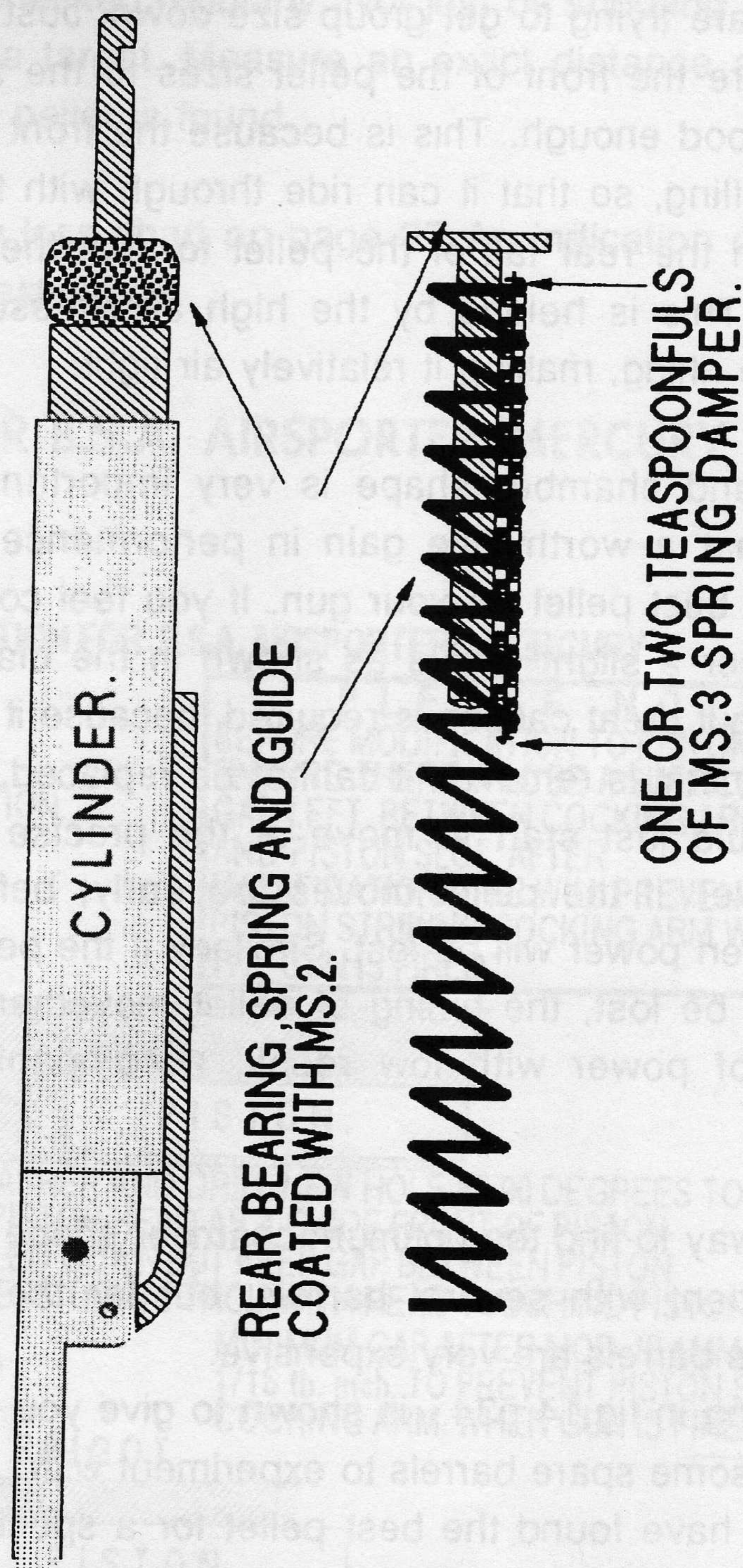


THIS AREA OF PISTON TO BE KEPT DRY
OF LUBRICANT (ALL AROUND.) THIS IS
TO PREVENT LUBRICANT FROM
GETTING TO THE FRONT OF THE
PISTON. THIS WOULD CAUSE DIESELING
AND ERRATIC SHOTS. THE PISTON CAN
BE FITTED WITH A SLEEVE TO PREVENT
LUBRICANT ESCAPING FROM PISTON
SLOT (shown shaded). DO NOT OVER
LUBRICATE SPRING.

SOME GUNS ALREADY HAVE A PISTON
SLEEVE ie.-

H.W. 80-85 AND DIANA 45.

LUBRICATING INSTRUCTIONS Fig. 12.



PELLETS

Sizing pellets can help eliminate the odd flyer you get when you were pretty sure it was a good shot.

Experimenting with the Robb adjustable pellet sizer can pay dividends when you are trying to get group size down. Just pushing pellets through a die, where the front of the pellet sizes to the same as the rear is not normally good enough. This is because the front band should be a good fit in the rifling, so that it can ride through with the minimum of friction. We rely on the rear tail of the pellet to seal the high air pressure from escaping. This is helped by the high air pressure forcing the thin tail against the rifling, making it relatively air tight.

Pellet fit and chamber shape is very important, and it is not always realised that a worthwhile gain in performance can be obtained from finding the best pellet for your gun. If you feel competent enough to give the chamber a slight radius as shown in the diagram this can also pay dividends but great caution is required, because it can easily be overdone, once this metal is removed it cannot be replaced. For optimum power the pellet should just start to move at the precise moment, in relation to piston travel. If the pellet moves too early, before full compression is attained then power will be lost. Similarly if the pellet moves too late, then power will be lost, the timing of pellet movement can give a surprising increase of power with low recoil, accompanied by minimum piston bounce.

The sure way to find the optimum chamber shape for your particular gun is to experiment with several barrels, but for the home tuner this is not practical as barrels are very expensive.

The drawing in fig.14 p34. is shown to give you the general idea in case you have some spare barrels to experiment with.

Once you have found the best pellet for a specific gun, it should not be taken for granted that it will always remain the best. This is because as the gun beds in, it is possible for it to change and then it may get to like a different pellet as it settles down. It may even start to perform better with a previously unpromising pellet.

Pellets Cont.

There may even be a new pellet on the market. These are always worth trying if you are after the maximum performance.

The accuracy must be checked regularly. Not just by shooting tin cans but by proper grouping on a target. Measure an exact distance and fire five shot groups till the best pellet is found.

If you study the velocity loss chart on page 37 An indication of the gun's maximum range can be estimated.

MODIFICATION FOR B.S.A. AIRSPORTER/MERCURY Fig. 13.

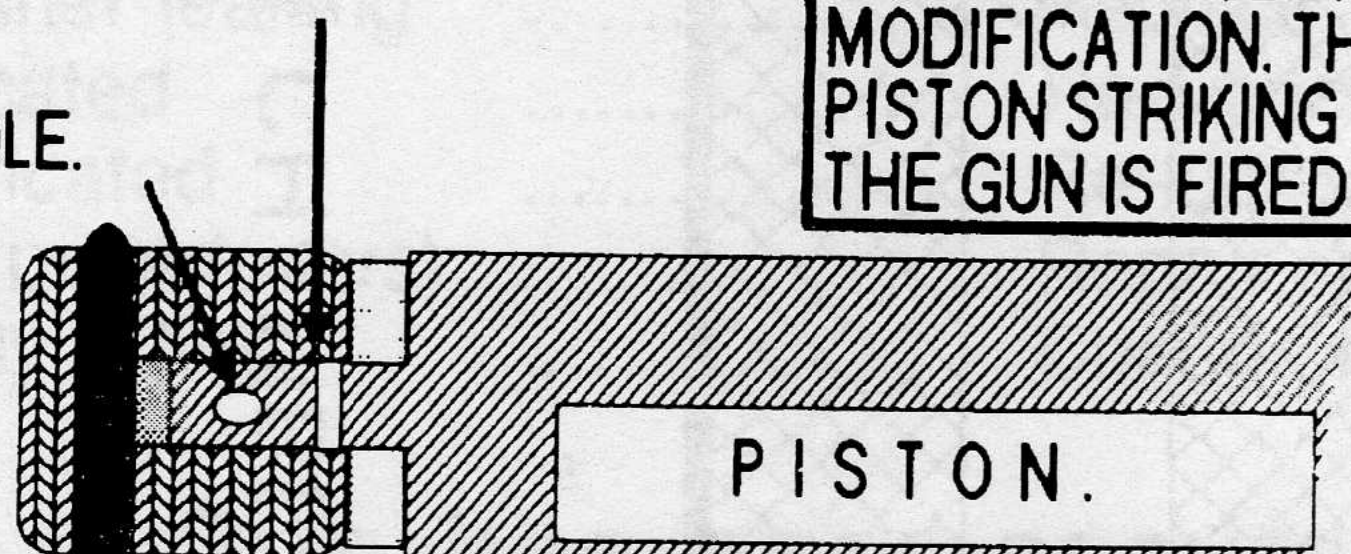
STROKE MODIFICATION FOR B.S.A. AIRSPORTER / MERCURY.

FIG. 13.

PLEASE NOTE.
BEFORE MODIFICATION TO PISTON.
ENSURE THERE WILL BE A SUFFICIENT
GAP LEFT BETWEEN COCKING ARM
AND PISTON SLOT, AFTER
MODIFICATION. THIS WILL PREVENT
PISTON STRIKING COCKING ARM WHEN
THE GUN IS FIRED.

NEW HOLE POSITION.
AT 90 DEGREES.

ORIGINAL HOLE.



PISTON.

REMOVE NYLON BUFFER WASHER AND DRILL NEW HOLE AT 90 DEGREES TO ORIGINAL HOLE, USING OLD PISTON HEAD AS A GUIDE. FRONT OF PISTON SPIGOT WILL HAVE TO BE FILED DOWN BUT KEEP GAP BETWEEN PISTON HEAD AND PISTON SPIGOT LESS THAN 5 THOU WITH HEAD TOUCHING PISTON.

KEEP THIS GAP TO A MAXIMUM, OF 5 THOU.

MINIMUM GAP AFTER MOD. IS 1MM. OR 1/16 th. inch. TO PREVENT PISTON STRIKING COCKING ARM. WHEN GUN IS FIRED.

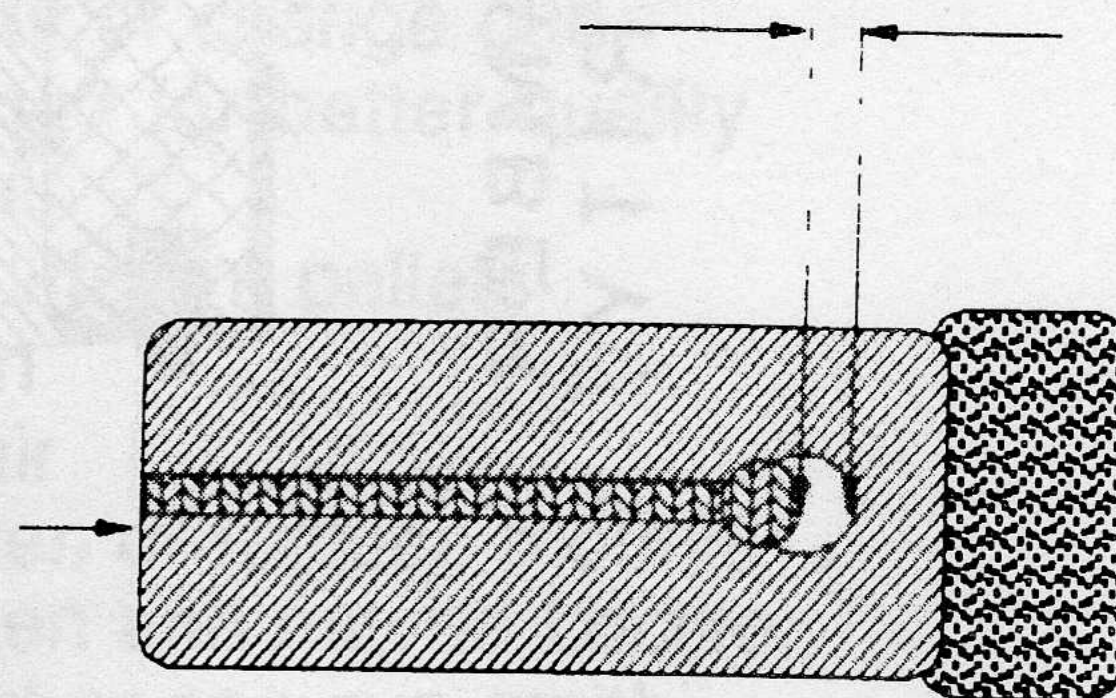
PISTON SPIGOT.



PISTON.

COCKING ARM.

NEW HOLE POSITION.
PISTON HEAD MUST TOUCH PISTON.



BARREL SECTION Fig 14

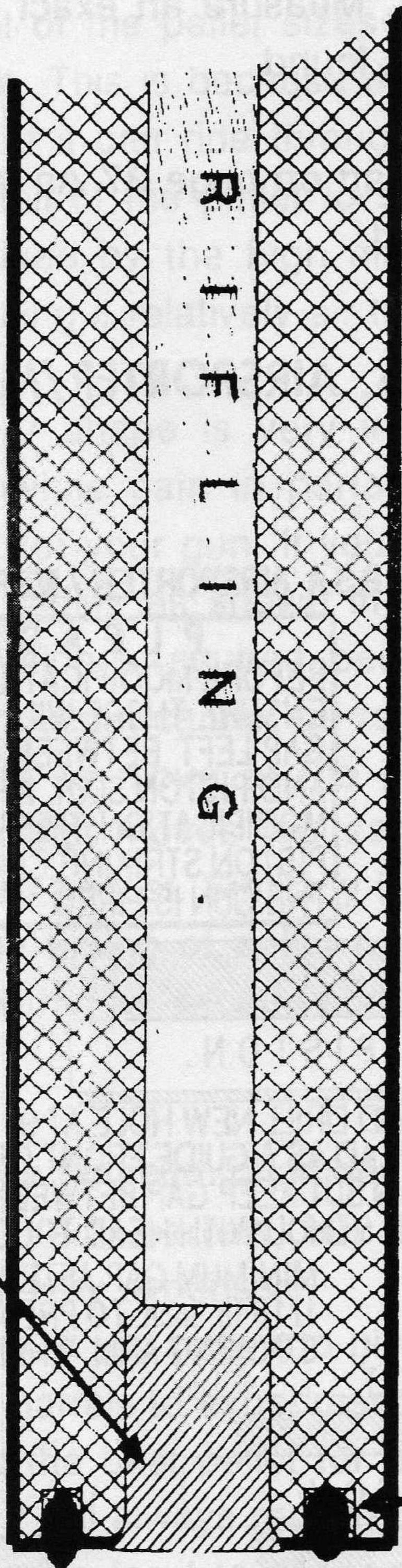
FIG. 14.

PELLET LOADING CHAMBER.

BREECH SEAL.

R I F L I N G .

EXAGGERATED CHAMBER
SHAPE FOR CLARITY.



TROUBLE SHOOTING

Gun does not cock?

Trigger over adjusted	Back off adjustment
Broken Mainspring	Replace
Broken spring guide	Replace with a better one
Trigger sear spring broken.....	Replace
Trigger spring broken	Replace
Sear worn or broken	Replace
Cocking arm bent	Straighten or replace
Piston rod broken	Replace Piston

You may have fitted a spring with too many coils or fitted a spring made of thicker wire. Also make sure Total thickness of piston weights does not make spring coil bound or touch spring guide before the sear engages.

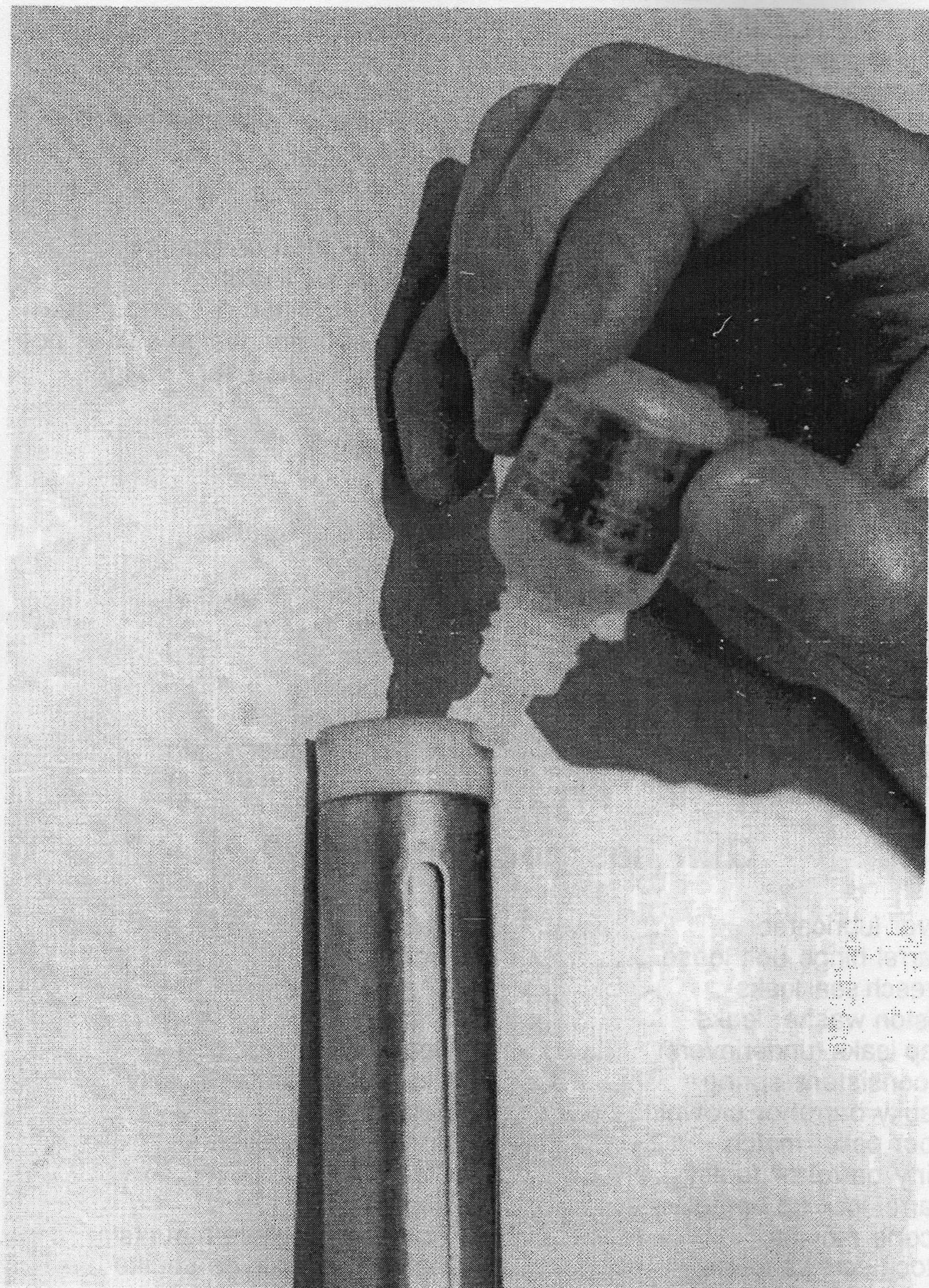
Gun has low power?

Poor pellet to match gun.....	Try different pellets
Breach seal leaking	Replace
Barrel lock up defective	Repair or change gun
Spring broken or weak	Replace
Piston washer leaking	Replace
Over lubricated	Re-lubricate
Under lubricated	Re-lubricate
Tap leaks (underlevers)	Repair or change gun
Poor quality rifling	Change barrel or gun

Gun has poor accuracy?

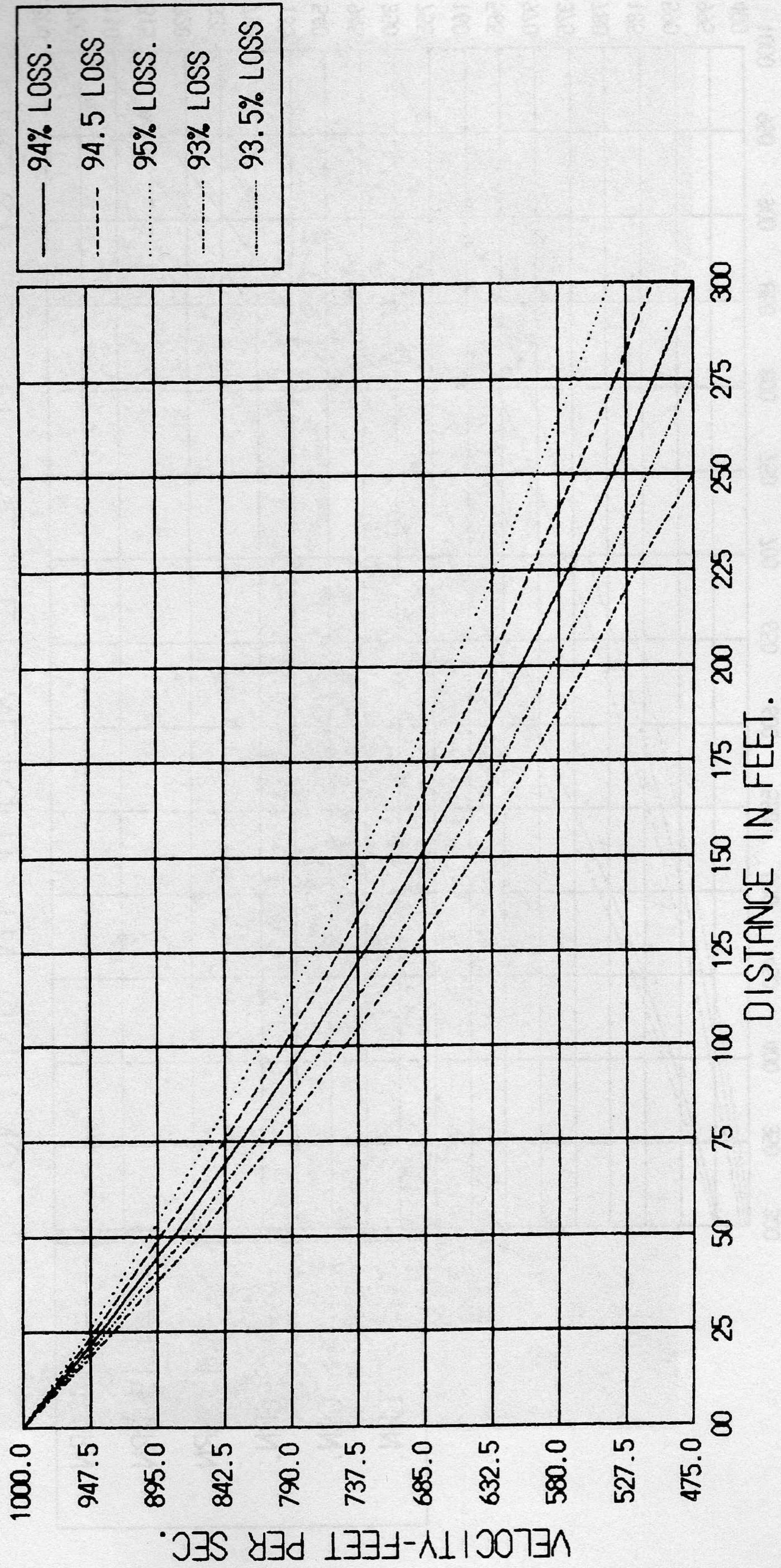
Over lubricated	Relube
Barrel hinge bolt loose	Tighten
Breech seal leaks	Replace
Piston washer leaks	Repair
Tap leaks (underlevers)	Repair or change gun
Inconsistent spring	Change for better quality
Faulty barrel or crowning	Repair
Poor pellet match	Try different pellets
Dirty barrel or fouling	Clean
Barrel lock up defective	Repair
Scope moving	Tighten or replace mounts
Stock screws loose	Tighten and maybe Loctite
Inconsistent trigger pull	Adjust or see gun smith

LUBRICATING WASHER



VELOCITY LOSS GRAPH

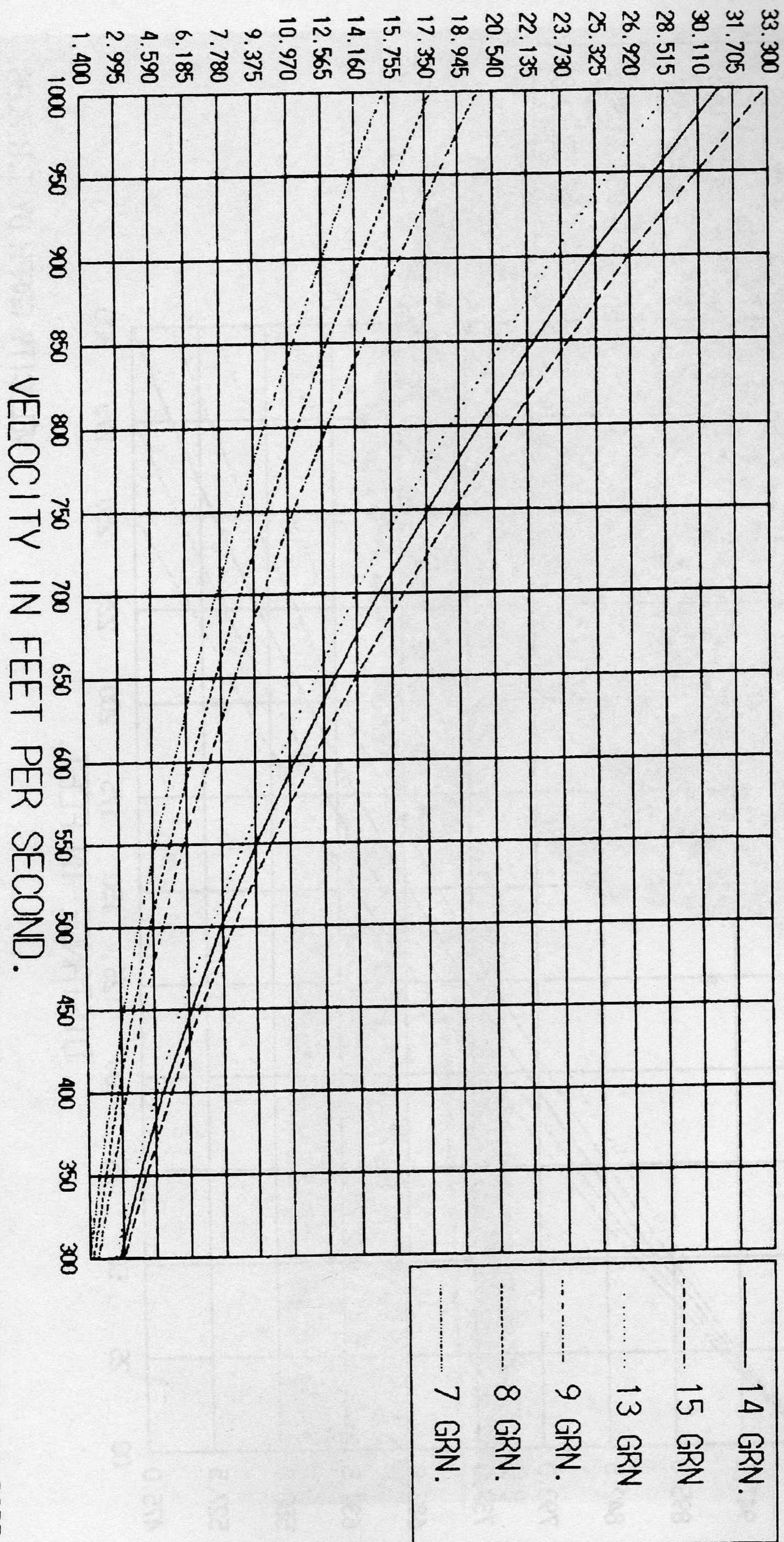
VELOCITY LOSS GRAPH.



VELOCITY GRAPH BY T.R. ROBB.

ENERGY OF PELLET

ENERGY IN FT LBS



LUBRICANTS

